

Fire Protection Planning Bulletin

Prepared for: U.S. Air Force Directorate of Engineering and Services and
Dept. of the Army HQ U.S. Army Corps of Engineers

Prepared by: EDAW, Inc., 601 Prince St., Alexandria, VA 22314

With assistance from: Kaiser Engineers, Inc., 1117 N. 19th Street, Arlington, VA 22209

August 1989

HQ USAF/LEEVX IS NOW HQ AFCEE/DGP
"REPRINT BY HQ AFCEE/DGP"

DEC 30 1993

Table of Contents

	Page
Chapter 1. Introduction.....	1-1
A. Purpose of the Planning Process	1-1
B. Scope	1-2
C. How to Use the Bulletin/Manual	1-2
D. Why Fire Protection (FP) Planning	1-7
E. What Is Fire Protection Planning	1-8
F. How Is Fire Protection Planning Used	1-10
G. The Planning Process.....	1-18
Chapter 2. Goals, Objectives and Inventory.....	2-1
A. Goals and Objectives.....	2-1
B. Inventory	2-2
Chapter 3: Defining the Fire Protection Situation: Forecasting and Analysis.....	3-1
A. Purpose	3-1
B. Functional Requirements for Facilities	3-1
C. Identifying Existing Problems and Risks.....	3-2
D. Assessing Deficiencies	3-5
E. Developing Alternatives	3-6
Chapter 4: Evaluation and Recommendation of FP Plan Alternatives.....	4-1
A. Purpose	4-1
B. Selection and Application of Criteria for Meeting the Goals and Objectives	4-1
Chapter 5: Community Relations.....	5-1
A. Agreements of Understanding with Local Agencies	5-1
B. Emergency Planning.....	5-2
Chapter 6: Implementing and Monitoring.....	6-1
A. Implementation	6-1
B. Monitoring.....	6-2
Appendix	
A: References	A-1
B: Data Collection and Surveys	B-1
C: Risk Assessment	C-1
D: N Tab /Existing Conditions Map Development	D-1
E: Model Statement of Work for a Contracted Fire Protection Plan	E-1

1

Introduction

Chapter 1

Introduction

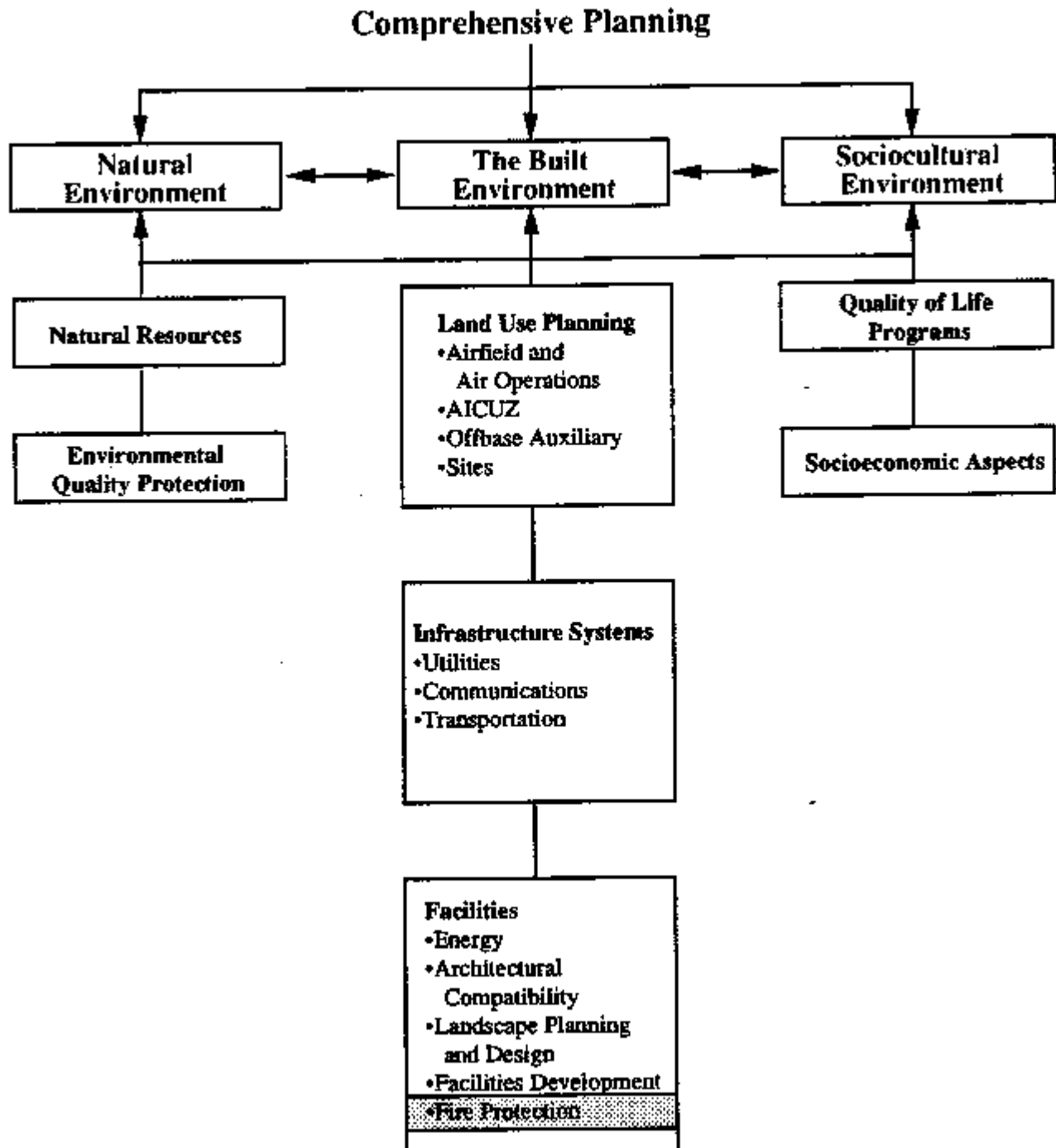
A. PURPOSE OF THE PLANNING PROCESS

1-1. The primary purpose of the planning process is to support and enhance the operational mission of the installation. The purpose of this bulletin/manual is to provide a framework for defining and then incorporating fire protection needs into the development and implementation of near-term and long-term planning, design, installation and construction programs. This bulletin/manual is prepared in the context of the Base Comprehensive Plan (USAF) and the Installation Comprehensive Plan (USA), hereafter referred to as The Plan (see Figure A). The expressed Army and Air Force goals of these documents are, to:

- Provide effective and efficient use of installation resources to support the mission.
- Direct the long-range development of the installation.
- Integrate a number of interrelated functional programs derived from other component plans of The Plan.
- Relate mission planning to policies, programs and specific projects for on installation facilities systems.
- Relate the needs of the installation to the social, cultural and economic aspects of the surrounding civilian community.
- Provide the basis for all decisions on siting of facilities and setting priorities and for preparation of the Five-Year Defense Program (FYDP) and other capital improvement programs, and long-range facilities renovations and replacements.
- Make optimal use of the latest developments in energy efficient concepts/ systems/technologies.
- Protect the natural and human environment.
- Provide the highest possible quality of life for the Air Force/Army community.

Figure A

Comprehensive Planning Components



1-2. It is essential that the fire protection goals and objectives support and reinforce the goals of The Plan as presented in the preceding paragraph. The primary reasons for fire protection planning are to ensure mission continuity, preserve and protect human life, and protect facilities and systems.

B. SCOPE

1-3. The Fire Protection Bulletin/Manual addresses those factors, codes and principles that need to be considered when developing The Plan. It covers the data collection process, the identification and evaluation of alternatives and possible solutions to meet near-term and long-term needs, and the implementation of selected fire protection recommendations.

1.4. The fire protection planning discussed herein is for peacetime only. Additionally, installations in theaters of operations must also include combat fire protection in their planning.

C. HOW TO USE THE BULLETIN/MANUAL

1-5. Content. The Fire Protection Bulletin/Manual is one of a series of bulletins/manuals supporting the comprehensive planning process for U.S. Air Force and U.S. Army installations. This bulletin/manual serves as a resource document for installation planners who recommend or plan near-term and long-term improvements at their installations. The bulletin/manual contains fire protection planning principles and methodologies, and is a valuable tool in assisting the planners in allocating tasks and support efforts to responsible organizations on the installation. Appendix D, N Tab/Existing Conditions Map Development, discusses the tabs and map series and provides examples to further assist the planners.

1.6 Terminology. Non-specific military terms have been used wherever possible in this document. In some cases, generic terms were devised to avoid using terms specific to the Army or Air Force. Please refer to the table below for the specific Army and Air Force definitions of these generic terms.

<u>Generic</u>	<u>Army</u>	<u>Air Force</u>
installation	post	base
the Plan (product)	the Installation Comprehensive Plan	the Base Comprehensive Plan (BCP)
Comprehensive planning (process)	installation master planning	Base Comprehensive Planning
the engineer	Director of Engineering and Housing	Base Civil Engineer (BCE)
the planner	master planner	community planner
major command	MACOM	MAJCOM

1-7. The format follows each step of the planning process. Therefore, the planner may start at the most appropriate section in the Bulletin/Manual, given the status of the program. A detailed Table of Contents serves as an index to individual topics. Throughout the bulletin/manual there are practical examples of fire protection planning principles applied to the specific needs on Air Force and Army installations. The planner can use the bulletin/manual as a reference guide in several ways:

- a. To help with day-to-day activities.

Steps:

- (1) Read Chapter I.
- (2) Read the appropriate sections of Chapter 2 for determining inventory needs.

- (3) Examine Chapter 3 tables to determine the forecasting and analysis needs for typical problems and opportunities. Then read the appropriate sections of Chapter 3.
 - (4) Read more about the evaluation process Chapter 4.
 - (5) Read Chapter 6 to determine appropriate ways to implement and monitor fire protection actions.
- b. To produce a fire protection plan using on-site personnel.

Steps:

- (1) Read Chapter 1.
- (2) Read Chapters 2 through 6 in order to understand the planning process.
- (3) Reread Chapters as needed during plan preparation.

c. To produce a fire protection plan with consultant assistance. Many studies involving significant inventory, forecasting, and analysis activities may require outside assistance. Use this bulletin/manual to assess which portions of the planning process can be adequately performed on-site. At that point, make a knowledgeable decision as to the amount of outside services that would be required.

1.8. Bulletin/Manual format. Typically, the bulletin/manual is organized as follows:

a. **Chapter 1. INTRODUCTION.** This chapter describes the function and goals of The Plan and the incorporation of the fire

protection requirements. The purpose of the bulletin/manual, its use and the fire protection planning process are also discussed.

b. **Chapter 2. GOALS, OBJECTIVES & INVENTORY.** This chapter presents the goals of the fire protection planning process and specific planning objectives. Additionally, the approach to obtaining and assessing the inventory data is presented.

c. **Chapter 3. DEFINING THE FIRE PROTECTION SITUATION.** This chapter describes the methodology for categorizing installation facilities. The need to define and assess the risks as a function of severity, probability of occurrence, time of exposure, cost and general compliance with governing documentation is highlighted. The need and methods for identifying future opportunities/alternatives to solve the problems is also provided.

d. **Chapter 4. EVALUATION AND RECOMMENDATION.** This chapter includes a discussion of applying selected criteria in order to evaluate alternatives and recommend a preferred alternative(s).

e. **Chapter 5. COMMUNITY RELATIONS.** This chapter discusses community relation benefits and some of the types of installation and community agreements.

f. **Chapter 6. IMPLEMENTING AND MONITORING THE FP PLAN.** This chapter discusses the implementation and monitoring process, and the coordination/incorporation of the Fire Protection Plan with the other plans.

g. **Appendices.** A description of risk assessment methodology, techniques to categorize and assess facilities and a list of references are provided. In addition, the N Tab/existing conditions map series are described and examples given.

D. WHY FIRE PROTECTION (FP) PLANNING?

1-9. Purpose

a. The comprehensive planning process enables the fire protection requirements plan to be incorporated into all components of the Base/Installation Comprehensive Plan (The Plan) in a timely, consistent and orderly manner.

There are three primary fire protection factors that the planner must consider:

- The need to ensure mission continuity;
- Preservation of human life;
- Protection of property, facilities and systems.

Primary Considerations:

1-10. Ensure Mission Continuity. As part of the comprehensive planning activity, the planner will have prioritized operational considerations and those essential to the installation's mission. Typically, specific functions will be more critical than others and these need to be clearly identified. By-protecting mission-essential facilities, operations and personnel, valuable resources remain operational. Loss of any or all of these assets means the application of additional dollars to return the function to mission status, and using funds that may have been used to increase mission performance and dependability. Therefore, fire protection features must be an inherent and integral part of any planning activities.

Mission Continuity

1-11. Preservation of Human Life

a. The protection and preservation of human resources have been and will continue to be of paramount concern. To be treated most effectively, the planner, installation engineers and fire protection experts must identify hazards and also define the role of the individual at the time a hazard/fire occurs. As an example, the

planner must be aware of and examine the fire protection factors involved in locating and then designing a hospital. Such factors are that the site must be highly accessible so that patients can be evacuated rapidly. Additionally, special attention must be given to utilities: adequate fire flow, emergency lighting, and backup power (e.g., generators) to ensure continued functioning of automatic detection, alarm and suppression systems. There must also be adequate means to evacuate personnel from the hospital, recognizing that some patients are non-ambulatory and will require extra time and protection.

Preserve Human Life

1-12. Protection of Facilities, Systems, and Property

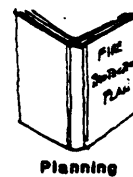
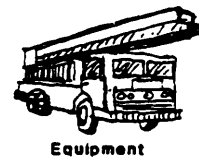
a. The planner must identify and prioritize those elements essential to the mission of the installation. Protective and security system measures, above those normally provided, must also be identified as they are necessary to ensure survivability.

Protect Property

1-13. Goals Achievement

a. To adequately address and achieve installation goals and objectives, the planner must realize that fire protection is a **common thread** integral to most components of The Plan.

Fire Protection Is



E. WHAT IS FIRE PROTECTION PLANNING?

1-14. Fire Protection Planning

a. Comprehensive planning is the orderly process of establishing acceptable goals, defining the resources necessary to achieve the goals, recognizing and analyzing constraints in the planning, then developing and implementing solutions that satisfy the goals. Fire protection (FP) planning provides a process to ensure on-site workers, residents and visitors of a safe and healthy environment under conditions which may be defined as normal, abnormal or an emergency.

b. FP planning considers a wide range of possible conditions and anticipates their severity and probability of occurrence. The planner and the appropriate technical staff members can then direct and monitor to ensure that the appropriate design measures are incorporated in the design of the facilities, equipment, site and/or community to limit/contain the spread of fire and to aid in the safe, orderly and rapid removal of individuals from the event scene if required. FP planning also incorporates the design features necessary to prevent, mitigate or control a hazard if it should occur, so that mission capabilities, that are often limited by fiscal constraints, can be preserved.

1-15. The Importance of the Fire and Life Safety Planning

a. The planner, having other component plans such as land use, utilities and transportation developed to a satisfactory level can then propose optimal fire protection features based on identified opportunities as well as constraints. In some cases, fire protection requirements can be modified, if the resulting protection is not comprised. An example would be the requirement that fire fighters have vehicle access to all sections of parking areas. Bollards and break-away chains are a means to limit or direct normal vehicular traffic, but still allow access by emergency vehicles (Figure 1-1).

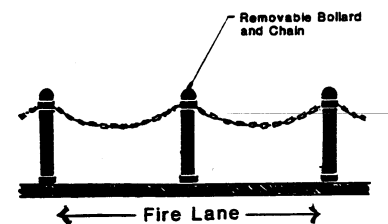


Figure 1-1

b. Conversely, if FP planning is not followed or developed in concert with other components of The Plan, FP needs may not be adequately addressed. For example, MIL-HBK-1008 establishes building separations based in part on construction, hazard classification and whether or not automatic fire protection systems have been installed. Automatic fire alarm and suppression systems are strongly encouraged because of their ability to detect, alarm and limit fire spread. However, the Fire Department's capability to readily access and possibly evacuate floors in a high

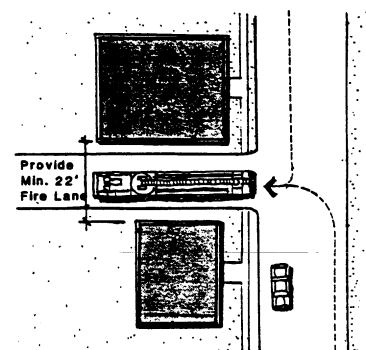


Figure 1-2

rise building especially, should not be compromised because a designer has incorporated features to reduce fire propagation. The construction of a hospital without satisfactory site access for fire fighters to use aerial ladders on a high rise section would unnecessarily restrict full access, as would the failure to provide a minimum 22-foot wide fire lane between it and other facilities. If fire protection concerns had been included, the access requirement would have been addressed in both the land use and transportation components (Figure 1-2).

c. Similarly, if the design/construction criteria do not fully adhere to or comply with latest Air Force and Army regulations, and national codes and standards, compliance may be mandated at some later date, resulting in: unnecessary costs; potential adverse public reaction; possible total or partial loss of usage of the facility; undesired compromise of the performance or usefulness of a specific system, facility or service. In this latter case, experience has proven that fire protection measures/design features that are added after the construction has begun or after completion not only cost more, but are less effective. For example, a fire hydrant is deleted as a cost savings during project design. Occupancy of the building is subsequently not allowed until a hydrant is installed. At this point in the process, the addition of a hydrant would cost approximately 10 times the cost of the savings.

F. HOW IS FIRE PROTECTION PLANNING USED?

1-16. The Role of Fire Protection in Comprehensive Planning.

The Plan provides a framework for installation planning and development activities. FP planning must be included in the overall comprehensive planning process as early as possible in order to assure its effective and timely influence. The land use, transportation and utilities systems plans, in particular, are key components that must reflect fire protection in their recommendations for installation development (Figure 1-3). The role of fire protection planning in these components and the types of information that the planner should

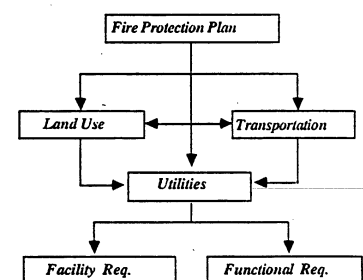


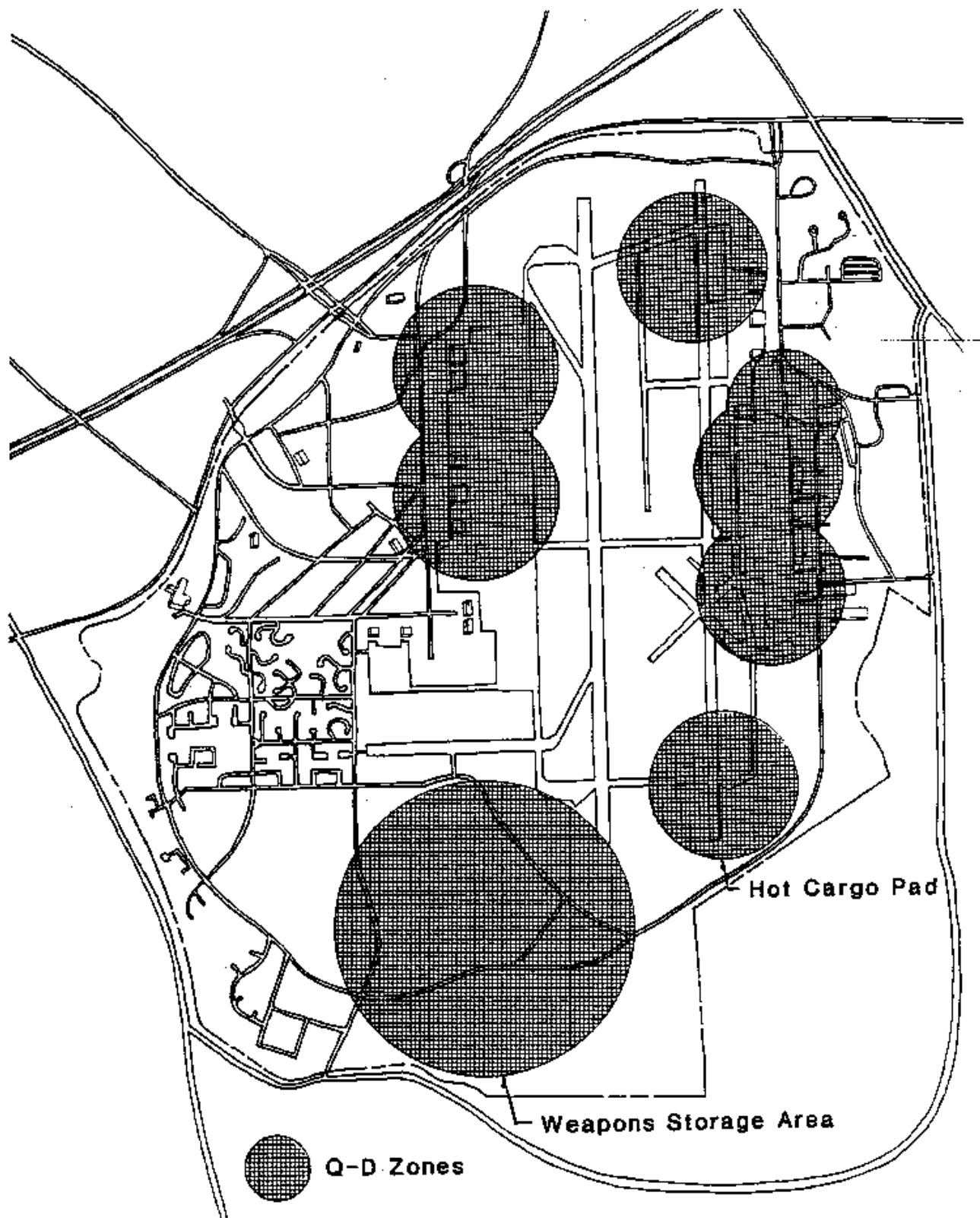
Figure 1-3

provide in the preparation of these component plans is described below.

a. **Land Use Plan.** The planner must effectively integrate all the physical and functional elements presently found on an installation or planned for the future. These include the natural environment, facilities and structures added for mission accomplishment and the functional linkages between facilities and activities. Again, an example is the need for complete access to inhabited facilities, such as a hospital. Another example of importance to the planner is in considering facility siting on the installation in relation to the storage of explosive materials. The separation of stored explosives (and the basic types of magazines) are defined in AR 385-64, TM 9-1300-206, AFR 127-100 and National Fire Protection Association (NFPA) 495, Manufacture, Transportation, Storage and Use of Explosive Materials. The separation from inhabited buildings, highways, roads, recreational areas and airfields is critical. Therefore, when defining land uses, planned facilities and their inter-relationships, the fire, life safety and the security system needs of the installation and the community must be addressed.

b. **Transportation Plan.** The planner along with installation engineers and specialists in transportation and fire protection planning must work closely together.

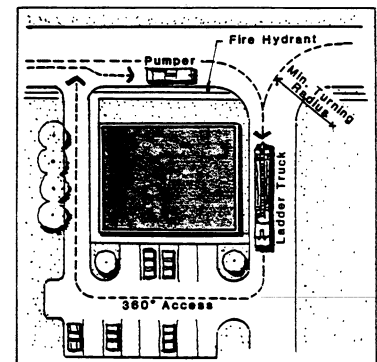
- 1) Using the example depicted in Figure 1-4, Explosive Q-D Zones, the fire department and emergency medical services response routes to the explosive storage area(s) must be carefully coordinated. Access roads, to the degree possible, should be planned so that response teams are not exposed to potential hazards of equal or greater severity. Similarly, the planner, engineers and fire protection experts must be apprised of all other sites where fire and emergency teams may respond in order to help develop direct routing to the scene while maintaining traffic in the unaffected areas of the installation.



Explosive Q-D Zones

Figure 1-4

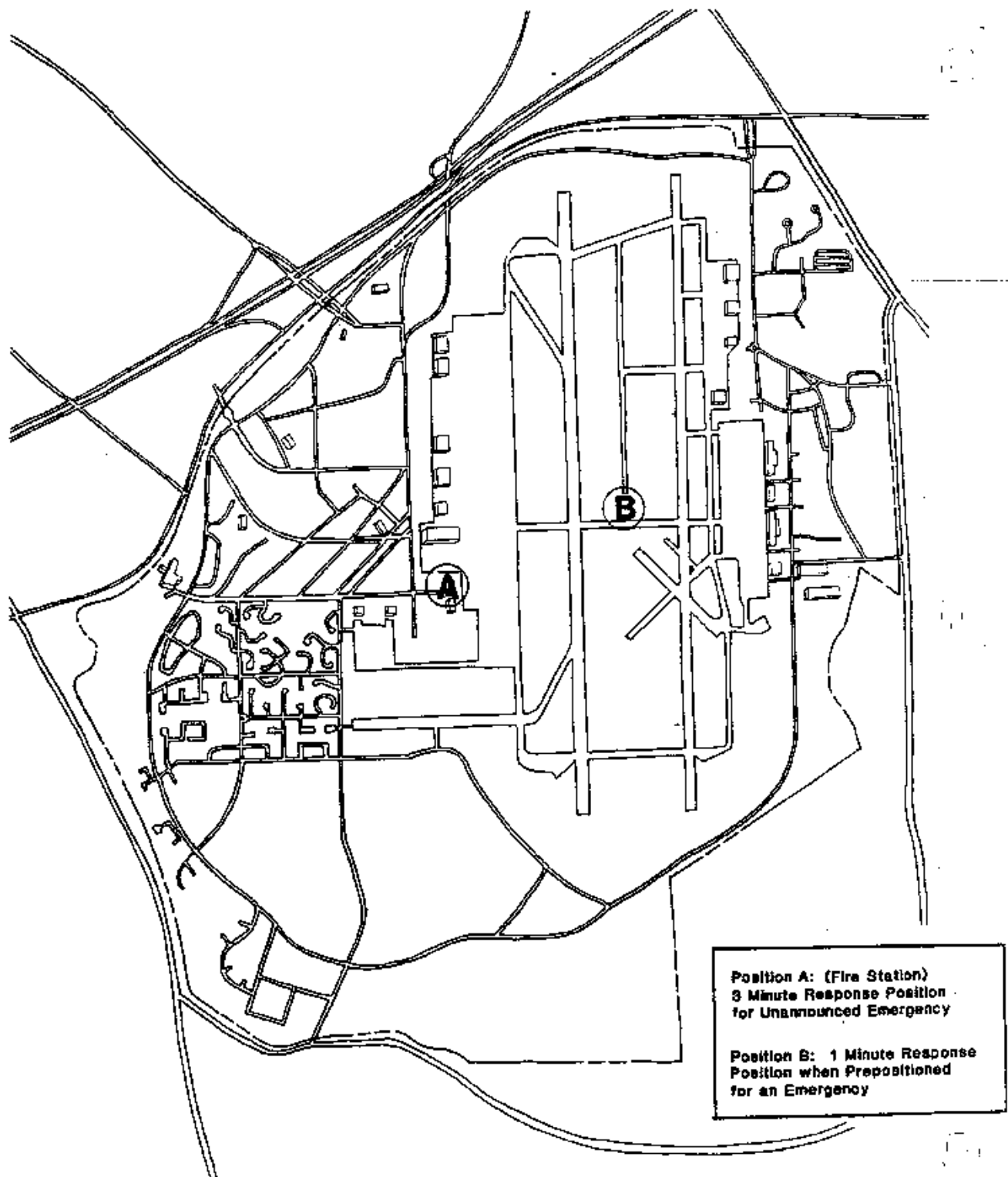
- 2) Another example of integrated planning would be for an airfield layout. The entire area around the field must be clear and accessible in the event of an aborted takeoff, emergency landing or a crash. The airfield is a critical installation function from a fire protection standpoint. Per DoD Instruction 6055.6, the first aviation, crash, fire and rescue (CFR) vehicle must be capable of responding to any incident on a runway or overrun within one minute after prepositioning, or within three minutes for an unannounced emergency. Figure 1-6 is an example of emergency response positioning.
- 3) In addition, the maximum travel distances/response times are mandated for structural fire companies, so these considerations further influence the transportation and land use planning. Figure 1-7 is an example of a response curve that could be used to determine the location of the fire station/emergency equipment.
- 4) The planner and experts must work closely together when analyzing siting and design considerations for facilities. Firefighters should have access to an area or facilities from 360°, as well as be able to use equipment with outriggers as necessary (Figure 1-6). This requires at the minimum 22-foot building separations, clearances and fire lanes. DoD Instruction 6055.6 provides additional guidance for facility separation. Siting and spacing provisions are particularly important in residential areas, or places of assembly such as a club or recreation center. The planner must also work closely with the installation engineer and other transportation experts to locate the roads and to provide access to properly located and tested fire hydrants, siamese connections and access/egress points in the various facilities.



360 Degree Access
Figure 1-5

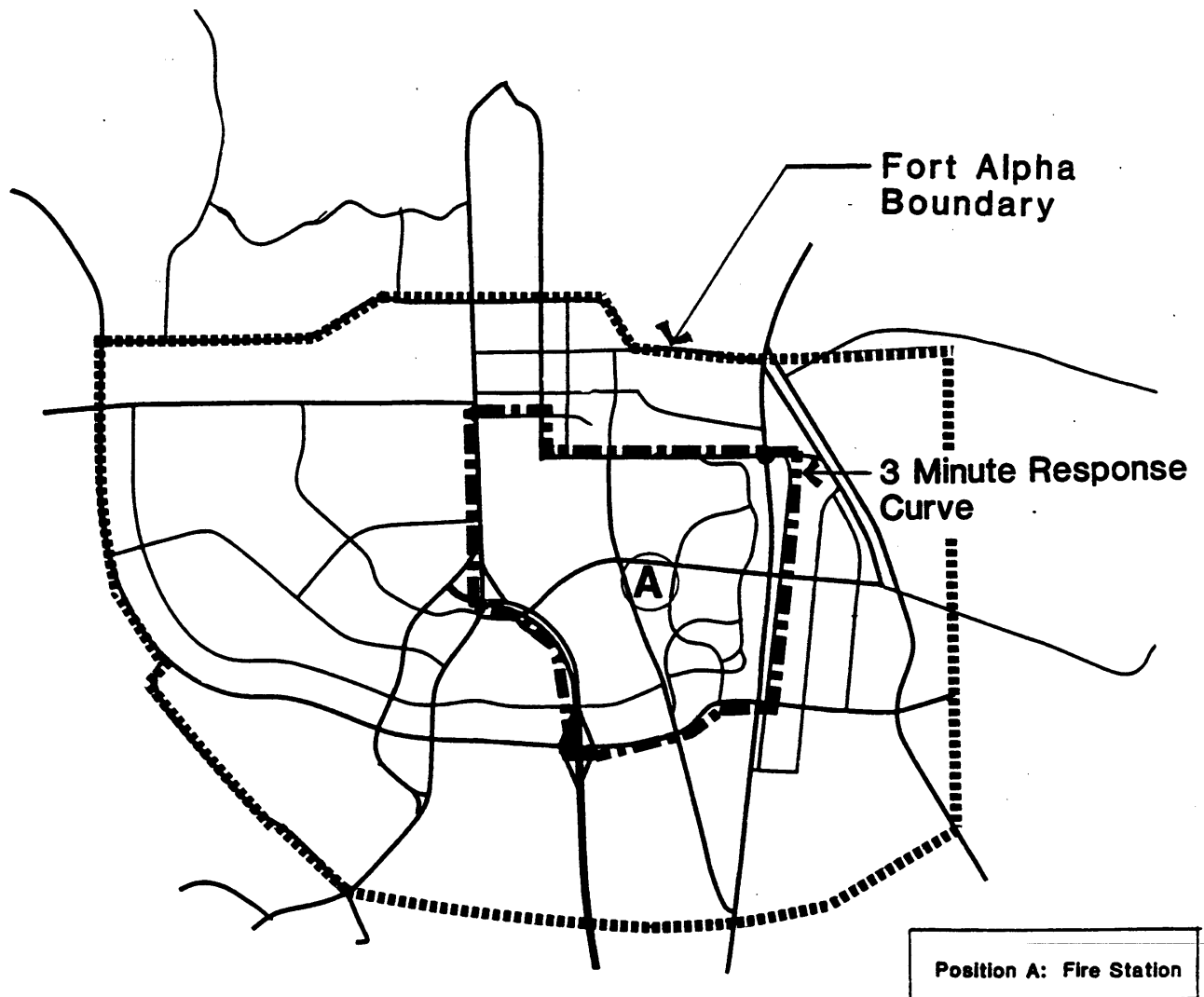
c. Utilities Plan

- 1) The planner must also address fire protection needs while developing the utilities plan. The level of protective requirements for mission support, training and educational buildings, maintenance facilities, equipment/parts storage, hospitals, the airfield and the control tower, and other designated areas must be coordinated. If underground lines are not installed,



Emergency Positions

Figure 1-6



Response Curve

Figure 1-7

then aboveground high tension power lines must be sited and installed so as not to present a hazard to the operation of aircraft, systems being tested and evaluated, or construction equipment such as cranes or manlifts. Electrical cutoffs should also be provided and identified so that emergency response personnel can electrically isolate facilities/areas as required.

- 2) The planner and utilities experts must also establish the water supply parameters as a function of flow and presence to meet fire emergency needs. Planning for the worst credible scenario, which could involve multiple situations, (again depending upon the known and long-term mission of the installation) is essential. Utility engineers must be made aware of any special water supply requirements, such as for fighting flightline fires, wooded area fires, special classes of POL fires or firing and test ranges. Additionally, any special needs of industrial facilities that could impact the fire flows must be considered.
- 3) The planner must be aware of specific fire protection requirements with respect to communications systems. As an example, the communication networks must integrate the requirements of numerous agencies to effectively communicate during normal and emergency situations. Planning for dedicated frequencies for the operations, maintenance, security and the fire department should be assessed in the initial stages in order to obtain FCC approval.
- 4) The planner and technical experts must also define any future requirements for fire detection and alarm systems, ensuring the applicable requirements of the National Fire Protection Association (NFPA) standards are met, such as for supervised and proprietary systems.

*Plan for the Worst
Credible Scenarios*

d. **Maps and Plans.** The "N" Tab series of maps for the Air Force and the fire and life safety existing conditions maps for the Army provide graphic support and information for fire protection planning within the context of The Plan. (See Appendix D for further discussion and examples.)

1-17. The Role of the Community in Fire Protection Planning

a. Mutual Support Agreements. Most installations are adjacent to communities where significant portions of the on-site working population may reside, where products for installation- use may be produced and other services may be tendered (Figure 1-8). In such circumstances, the installation and community typically enters into reciprocal agreements for mutual firefighting assistance. Example of these agreements are in DoD Instructions 6055.6 and AFR 92-1, Attachment 4. The nature of the support depends on the capabilities of each. This agreement allows each to use the others equipment, facility and manpower resources in the event of a man-made or natural disaster. The planner needs to clearly identify the community resources available, when these resources may be used and how/where firefighters can access the installation. Similarly, the planner must work with the community to identify their resources and determine how they can use them. Factors to be addressed include:

- Equipment, size, gross vehicle weight and axle load. Such questions as "Are the gates large enough?", "Will the roads and/or bridge handle the gross vehicle weight and axle load?" must be addressed.
- Communication procedures including special protocol, nomenclature and dedicated frequencies.
- Chain of command. Who is in charge in an emergency? Normally when the emergency is in the community, the installation personnel normally should report to the Fire Department Incident Commander. On-site, the installation's fire chief would be in charge.

b. Local Fire Protection Planning. The planner must closely track off-site future planning as well. As an example, are future highway/road developments planned that may be used for the movement of hazardous materials in/near the installation? Is there

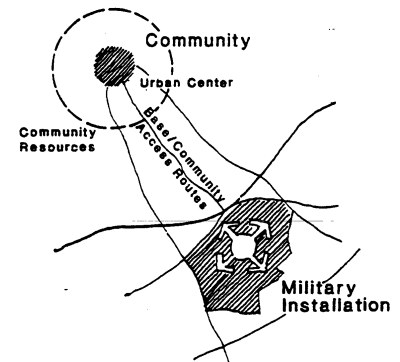


Figure 1-8

future industrial development planned in the community that could constitute a hazard to installation operations or personnel? This information is important for the planner to know, in that something like a chemical spill adjacent to the installation could force an evacuation, thereby adversely affecting the mission of the installation. Also, an explosion could destroy or damage mission- critical equipment.

G. THE PLANNING PROCESS

1-18. Planning Phases. Fire Protection planning considers both existing and future time frames, where the future includes both short and long-term periods. All the major planning activities, such as the **LAND USE, TRANSPORTATION, UTILITIES SYSTEMS and COMMUNICATIONS must be fully integrated and coordinated** so that the near-term and long-term needs can be accommodated from the beginning, rather than assuming a reactive role.

There are four (4) phases in the fire protection planning process:

- a. Identification
- b. Evaluation
- c. Implementation
- d. Monitoring

These phases are summarized in the following paragraphs, and discussed in detail in the subsequent chapters (Figure 1-9).

a. **Identification.** During the identification phase, the planner must obtain the following information. In some cases the planner will develop this information, however, it most likely will be generated by others.

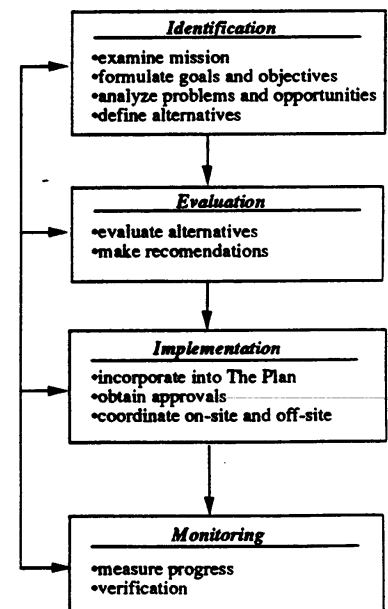


Figure 1-9

- Goals and objectives policies in FP must be formulated as they relate to the installation and community.
- The overall Fire Protection (FP) situation for the installation and the community must be identified.. Data must be assembled, which is described in Chapter 3, that is unique to FP and applicable for the other component plan disciplines.
- Perform a comprehensive survey that includes the following:
 - The primary mission of the installation as defined in its present scope and any contemplated future changes to the mission. If future changes in the mission are envisioned, how the other elements examined in the survey are affected.
 - The extent and density of the populated and nonpopulated areas.
 - The types and construction of the facilities on the installation; and any off-site facilities requiring possible firefighting support.
 - The geographic and possible natural and manmade barriers that impede or prevent access to facilities on the installation or between the installation and the community.
 - Existing fire protection data, and systems and resources available.
- Analyze risks/problems to determine existing constraints and future requirements.
- Provide definition of alternative means to attain the desired FP capabilities for both near-term and short-term needs. The priorities for the alternatives must be established and the risks to personnel and property must be presented for each proposed alternative.

Identification

b. **Evaluation.** After completing the survey, the next phase is to evaluate the conditions and the adequacy of the existing and planned FP measures. Some of the important activities include:

- Address the impact of the alternatives on the ability to perform the present and future missions. Measure the effects on social-economic-political-environmental conditions.
- Provide prioritized recommendations based on evaluation criteria.

Evaluation

c. Implementation

- Ensure the recommended measures are implemented in as timely fashion as possible.
- Verify that the long and near-term recommendations are compatible and complementary and are capable of realizing the maximum cost benefit.
- Ensure that the recommendations have been fully coordinated with other components and incorporated in The Plan.

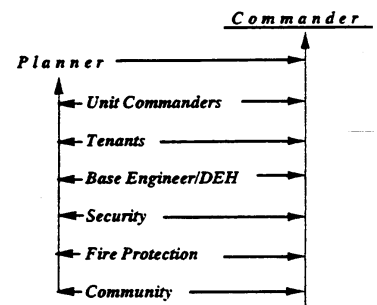
Implementation

d. Monitoring. Planning is not a one-time effort, rather it is a dynamic, ongoing process that requires continuous assessment and updating to be effective, so the planner must:

- Monitor the implemented recommendations to verify that the desired goals and objectives (including those of fire protection) have been met. If not, additional measures or actions that may be necessary must be identified.
- Assess any perceived risks as a function of time and mission accomplishment.
- Update the fire protection plan in accordance with changing installation conditions.

Monitoring

1-19. Who is Involved. Cooperation and communication between the key personnel both on and off the installation must occur early in the fire protection planning process to ensure timely and meaningful inputs. These individuals and their responsibilities include:



a. **Installation Commander.** The ultimate responsibility for a comprehensive and coordinated planning effort in all areas resides with the installation commander, who must be kept current on progress and findings throughout the entire process. The commander is responsible for ensuring that total mission requirements are accommodated in the fire protection plan component. This also means the fire protection specialist must be very knowledgeable of the facilities and their operations so his/her best professional judgments can be provided to the commander and the planner in a timely manner.

Installation Commander

b. **Fixed Wing or Rotary Aircraft Unit Commander(s).** The protection of the mission personnel and the aircraft inventory is vital from a mission and a cost perspective. The planner must recognize the normal, abnormal and emergency support measures that could be required and work with the commander(s) to ascertain the FP requirements. If there is more than one such tenant organization, the role and requirements of each should be noted.

Aircraft Unit Commander

c. **Commanders of a Special Facility, Tenant Unit, Agency or Activity.** Often with tenant organizations and special facilities there are unique risks, hazards and concerns. Those involved with FP planning need to be aware of any unusual or additional risks and/or hazards so that the proper/adequate measures and response modes have been incorporated in the planning. In addition to identifying these special conditions, the commander(s) are responsible for developing and providing long-range and five-year requirements to the planner.

Special Facility Commander

d. **Air Force BCE/Army DEH.** This office is responsible for ensuring that The Plan is prepared. It also coordinates the five-year installation plans and schedules on-facility construction plans. The planner(s) within this office develop and maintain The Plan and its components. The engineer(s) provide the technical input

BCE/DEH

to their preparation as in the case of transportation, utilities and communication systems.

e. **Unit Commanders.** The support measures for attached and permanently assigned units need to be considered when developing the overall FP program, resource requirements.

Unit Commander

f. **Community Representatives.** The various agencies and activities in the adjacent community should be interviewed to identify concerns and needs, and to solicit inputs regarding the operation of medical and emergency services, transportation- related matters, and other matters of joint concern.

g. **Installation Fire Chief/Fire Marshal.** In the Army, the Fire Marshal is assigned to DEH, and is normally delegated the responsibility for conducting surveys in support of the various fire protection planning activities. In the USAF the Fire Chief reports to Base Civil Engineer, who is the installation Fire Marshal. Both support the planner as the fire protection specialist establishing FP needs for future plans and addressing/evaluating the issues related to existing facilities and systems.

*Installation Fire Chief/
Fire Marshal*

h. **Facility Security Officer.** The Facility Security Officer is in charge of implementation of the various security system guidelines and regulations that apply to the electronic and physical measures required to secure the site.

1-20. The Installation and Community. The planner must remain aware of the important relationship that exists between the installation and its adjacent communities. This may take the form of mutual firefighting assistance agreements to ensure adequate manpower and resources are available to protect facilities, personnel, utilities and property. The level of installation dependency on community resources shall also be clearly defined. **The continuation and enhancement of such relationships must remain paramount in the planning process.**

Facility Security Officer

2

Establish the Goals, Objectives & Policies

Chapter 2

Goals, Objectives and Inventory

A. GOALS AND OBJECTIVES

2-1. The planner must look to the Fire Protection (FP) experts (Fire Marshal/Chief) to help establish the FP goals and objectives early in the identification phase of the planning process (Figure 2-1). Those developed must be, to the greatest extent possible, **compatible with the overall goals and objectives of the Base/Installation Comprehensive Plan (The Plan) and those of the other Plan components.**

2-2. Definitions (Figure 2-2)

a. The Fire Protection goals are the general statements of the desired end of the planning effort. The FP goals are:

- Fundamental. Represent basic desires and needs of the installation and community.
- Inclusive. Encompass all aspects of FP: personnel, facilities, mission needs, public and private, installation and community.
- Qualitative. Define relative measures of FP protection, not quantitative requirements.
- Future-oriented. Relate to the future planning activities and the role of FP more than current activities.

b. Objectives are developed from the goals, and should be carefully defined, specific, attainable and measurable. Objectives are:

- Attainable. Should be capable of being achieved within a specified period of time.

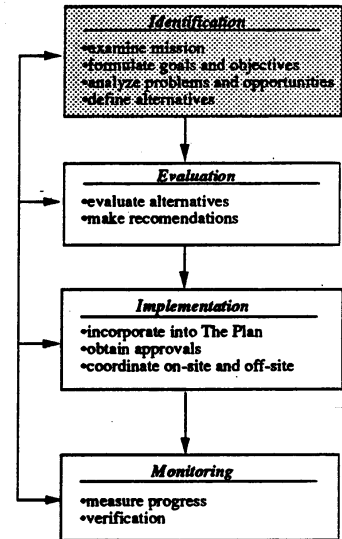


Figure 2-1

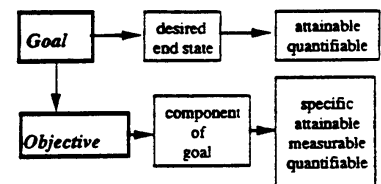


Figure 2-2

- Independent of the methodology or measures used to achieve them.

Each goal may involve several objectives, and one objective may serve more than one goal. Table 2-1 depicts some sample goals and objectives for Hometown Air Force Base and Table 2-2 for Ft. Alpha.

B. INVENTORY

2-3. Purpose

In order to fully understand the current Fire Protection (FP) conditions on an installation and in the adjacent community, it is necessary to perform a thorough inventory. The planner needs to know:

- What data should be collected.
- Where to go for the applicable data.
- What the future requirements are compared to what is currently in the field and what are the gaps/deficiencies.
- How do the deficiencies impact near and long-term mission requirements and continuity.

*Thorough Inventory
is Required*

2-4. Data Sources

a. The required information may be obtained through: published documentation, field surveys and observations, accident and incident reports and analyses at this or other installations. Historical information on safety can be obtained from Ft. Rucker, Alabama or Norton AFB, California (IG). Codes, standards and technical orders (see references); and data gathered in support of other components of The Plan can also be obtained for reference.

b. Published documentation would include:

- 1) Land Use Plans. Present and proposed land use is provided in these plans. This will help identify future FP needs.

**TABLE 2-1: HOMETOWN AFB:
SAMPLE GOALS AND OBJECTIVES**

MISSION: Provide training and support for an F-15 Wing Aircraft.

FIRE PROTECTION GOALS:

1. Provide a fire protection program that recognizes and specifically addresses the mission and mission-related equipment adequately.
2. Eliminate or reduce to the extent possible the loss of life or injury.
3. Eliminate or reduce to the extent possible the loss of or damage to equipment and support facilities.
4. Reduce the potential for injuries to firefighters and emergency response personnel.
5. Reduce the probability for installation property loss.
6. Establish a reasonable balance between the engineering and operational costs and the level of protection for equipment and personnel.
7. In cooperation with the community, develop a disaster preparedness plan.

FIRE PROTECTION OBJECTIVES:

1. Define fire protection requirements for each mission-related facility and support equipment. For facilities, define the safety needs and performance requirements in terms of codes and standards.
2. Develop inspection and maintenance requirements to ensure that the facilities and equipment are properly maintained and in satisfactory operating condition.
3. When the mission requirements change, review the protective measures for the facilities and equipment for suitability and feasibility, and recommend applicable changes.
4. Participate in fiscal reviews. Perform cost-benefit studies and trade-offs analyses to provide management with an objective assessment of risk to the mission assets while continuing to perform the mission.
5. Develop and conduct training programs to maintain proficiency for installation firefighters and emergency response personnel. As part of this effort, develop and conduct joint community-installation training programs.
6. Conduct installation-wide drills and simulations to familiarize all personnel with disaster planning.

**TABLE 2-2: FORT ALPHA
SAMPLE GOALS AND OBJECTIVES**

MISSION: Provide training and support for an MIAI Tank Unit.

FIRE PROTECTION GOALS:

1. Provide a fire protection program that specifically addresses the mission and mission-related equipment, such as the M-88 recovery vehicles and MI and M88 maintenance facilities.
2. Eliminate or reduce to the extent possible the loss of life or injury, such as through predefined detection and suppression systems.
3. Eliminate or reduce to the extent possible the loss of or damage to mission support and mission critical equipment.
4. Reduce the potential for injuries to firefighters and emergency response personnel.
5. Reduce the potential for property loss.
6. Establish a reasonable balance between the engineering and operational costs and the level of protection for equipment and personnel.
7. In cooperation with the community, develop a disaster preparedness plan.

FIRE PROTECTION OBJECTIVES:

1. Define fire protection requirements for each mission-related facility and support equipment. For facilities, define the life safety requirements in terms of codes and standards.
2. Develop inspection and maintenance requirements to ensure that the facilities and equipment are properly maintained and in satisfactory operating condition.
3. When the mission requirements change, review the protective measures for the facilities and equipment for suitability and feasibility, and recommend applicable changes.
4. Participate in fiscal reviews. Perform cost-benefit studies and trade-offs analyses to provide management with an objective assessment of risk to the mission assets while continuing to perform the mission.
5. Develop and conduct training programs to maintain proficiency for installation firefighters and emergency response personnel. As part of this effort, develop and conduct joint community-installation training programs.
6. Conduct installation-wide drills and simulations to familiarize all personnel with disaster planning.

- 2) Transportation Plans. This plan will contain traffic studies and analyses that the planner, after verification through field observation, can use to analyze emergency response routes. It will also link future facilities and growth to existing conditions.
- 3) Environmental Impact Statements (EIS). As future facilities are planned, DoD agencies are required to assess ecological impacts. This can provide the planner with insight to potentially hazardous operations and material use.
- 4) Real Property Records. These records are useful in defining the location and functions of the organizations on the installation.'
- 5) BCE/DEH studies and analyses. Often special studies are performed to determine alternative means to meet increased utility consumption or to relocate/ provide for a tenant organization. These studies can be useful in analyzing and assessing future needs. This office also maintains the records for the location of fire hydrants, water sources, electrical cutoffs, primary and backup power supplies, fuel isolation valves and cutoff valves, utility lines and distribution networks, as well as zoning in adjacent communities. These offices should also have development plans on file that include facilities and utilities proposed.

Published Information

c. Field surveys and observations would include:

- 1) Fire department surveys of installation facilities and fire protection measures. The fire department (Fire Marshal/Chief) on the installation will have determined if the existing protective measures are in compliance with existing codes, standards and tech orders. Older structures may not comply with current codes and full compliance may not b e justified unless:

- The hazard is serious.
- The purpose of the facility is changed.
- The facility is modified/upgraded.

Field Survey

Appendix B includes a summary of the codes applied to various types of facilities and services on the installation.

Table 2-3: DATA SOURCES FOR FP PLANNING:

<u>Source</u>	<u>Relevant Data</u>
Land Use Plan	Existing land use locations Future land use locations Mission critical facilities Current/Proposed operations
Transportation Plan	Emergency access routes Future transportation facilities
EIS	Locations of hazardous operations Hazardous material use/storage
Real Property Records	Existing facility descriptions/functions
BCE/DEH	Special utility studies Locations of: Fire hydrants Water sources Electrical cut-offs Power supplies Fuel isolation valves Cut-off valves Utility lines Development plans
Field Surveys	Facility code compliance Emergency routes Transportation routes for hazardous materials Alternate access routes
Ft. Rucker Norton AFB Navy Center National Fire Center FEMA	Accident and incident data

- 2) The planner should ensure that the surveys conducted have included field trips to validate such key factors such as: emergency routes to different installation sites and off-site facilities; routes used by off-site teams responding to an emergency on the installation; and routes used to remove waste products and move toxic and combustible materials. The planner, working with the transportation/engineering experts will help identify alternate routes as required to avoid roads through or adjacent to high population areas and those routes with statistically high accident rates.

d. Accident and Incident Data. The installation's safety office will maintain records of ground and facility accidents. This information can be correlated with service-wide data obtained through the Air Force IG at Norton AFB, California and the Army's Safety Center at Ft. Rucker, Alabama. However, other sources such as the Navy's Safety Center, the National Fire Academy and the Federal Emergency Management Agency should be solicited for applicable data. Uses include defining preferred access routes, design deficiencies, and areas of unusual or unexpected risk.

Accident Data

e. The data collection must be done accurately, and the information gathered must be thoroughly documented. Maintaining good records permits the planner to quickly retrieve and review the work at some later date. It also enables others to use and validate the results of the data collected. If the results can not be duplicated/verified, the entire process becomes suspect and the value of the effort could be compromised.

Keep Good Records

2-5. Facility Survey

a. **The survey of the facilities for an in-depth assessment of the fire protection status is normally done by the Fire Chief/Fire Marshal** and includes information on the age, type of construction, layout of the facility and fire-protection measure details: e.g.; sprinkler locations; fire extinguisher locations; egress routes and their adequacy; security system devices and systems; fire lanes; separation of facilities from one another; access

locations by firefighters and if special equipment is required to enter upper floors or remove personnel from upper floors. The survey should reference specific codes, as applicable when establishing fire protection requirements.

b. Of prime importance is documentation of **common-use facilities** which may be occupied by several different types of agencies or activities, and should be usable by each.

c. In fire protection planning, facilities are classified according to the hazard in accordance with MilHandbook 1008. In addition to light and ordinary hazards (categories 1, 2 and 3) there are also special occupancies that include the fixed wing and rotary airplane hangers, ordnance facilities, engine test cells and high rack storage areas (see paragraph (9) Special Occupancies below).

d. The facilities are also classified according to occupancy types, based upon the Uniform Building Code, MilHandbook AFM 88-15 and NFPA 101, Life Safety Code. These should be consulted for additional guidance to aid the survey party in establishing future fire protection needs. For initial data collection, the following categories are used:

- 1) Places of Assembly. This includes those facilities where large groups of people can assemble, such as the church/chapel, theater, youth center, NCO/enlisted/officers clubs, gymnasium, recreation centers and bowling centers.

Places of Assembly

- 2) Medical Facilities. This group includes the hospital and other medical facilities such as the flight surgeon's office and dental clinic if separate from the hospital. In MIL-HDBK-1008, nurseries and correctional facilities are also grouped in this category while separate in NFPA 101.

Medical Facilities

- 3) Educational Facilities. This group includes a wide range of facilities depending upon the installation and the location of the classrooms. For example, classrooms located in a maintenance facility might be more effectively covered under that facility, as it could be a single structure with multiple occupancy (the term "occupancy" refers to the specific type of activity taking place. For example,

Educational Facilities

a paint shop, offices and garages have different risks associated with them, therefore for fire protection purposes they are treated as different occupancies). This group normally includes military dependent schools, nursery schools and technical and training classrooms.

- | | | |
|----|--|-------------------------------------|
| 4) | Residential. This group includes those structures normally categorized by code as dwellings; family housing (single or multiple units); enlisted and NCO quarters; BOQ; and guest housing. | <i>Residential</i> |
| 5) | Mercantile. This group includes the exchange, commissary and on some installations, a separate toyland/garden shop. In MIL-HDBK-1008, the above are grouped with garages, offices and factories. | |
| 6) | Business. This group includes business or office- type activities, such as; the post office; headquarters; finance and personnel offices, and fire stations. | <i>Business</i> |
| 7) | Industrial Facilities. This group includes all maintenance activities and various shops (except those for aircraft), motor pool, service station and Corps of Engineer's repair facilities for light and heavy equipment. | <i>Industrial Facilities</i> |
| 8) | Storage. This group includes structures used to store or shelter property, merchandise, and includes warehouses, truck terminals, parking garages and aircraft hangers where no work is done. The hazard classification is based upon the commodity stored and the method of storage. | |
| 9) | Special Occupancies. | |
| | <ul style="list-style-type: none"> • The following are considered in this group: Aircraft maintenance facility and area; POL storage and distribution system; aircraft hangers, which can be part of the maintenance area, but are handled separately for fire protection, flightline equipment, such as tugs, automatic and ground test equipment, starter units; control tower, and the different occupancies therein. • High-risk areas require special attention regarding protective measures and the method firefighters and other emergency personnel use in response to an incident/accident. Some | <i>Special Occupancies</i> |

services/activities/facilities that may be considered in this category include: explosive storage sites; aircraft in standby or on alert with munitions onboard; nuclear/radio-active material storage; storage facility for jet fuel; Research and Development facilities; firing/test ranges (where new weapon systems are tested, and there are live firing, and simulated emergencies); armament repair; paint spray booths and areas; hydrogenization processes; and hazardous material areas (as defined under federal right-to-know laws, or state laws, if applicable).

2-6. Fire Protection Provisions in Facilities

a. As part of the data collection process, which includes categorizing the facilities, the fire protection features incorporated in each facility must be identified. As mentioned previously, **the planner would normally request the Fire Chief/Fire Marshal or a representative from that office to perform the survey.** (Tables B-1 in the Appendix is an example of the features that should be surveyed and Table B-2 is an example of a survey for identifying fire protection requirements). Those conducting the survey should use the following governing documents in the order in which they appear.

- Applicable, existing Air Force or Army technical orders.
- Installation supplements to existing regulations.
- Service regulations.
- DoD regulations.
- Standards and codes, such as from the National Fire Protection Association (NFPA).

Document Existing Fire Protection Features

b. Once the baseline survey has been developed, it can then be used for assessing the suitability of existing measures and establishing future fire protection measures. Supporting and sustaining mission requirements are paramount concerns and must be kept in the forefront by the planner in the Fire Protection planning process.

2-7. Fire Protection Resources

a. The installation fire protection resources are developed in accordance with DoDI 6055.6, MIL-HDBK-1008, plus numerous Army and Air Force regulations and manuals. The individual(s) performing the survey must also identify requirements above those deemed "basic" for the installation (See Appendix B).

b. DoD installations are encouraged to seek assistance from local fire protection departments to supplement installation capabilities and resources. Firefighters and their equipment located in the community should be identified, along with their personnel qualifications/training. If the qualifications and apparatus provide the installation unique/critical capabilities, this should also be identified. Additionally, the travel distances and the response times of off-site units to different sections of the installation should be documented.

c. The need for explosive containment facilities must be defined. When planning new facilities, the safety office and the Fire Chief/Fire Marshal should be consulted to determine future needs as well.

d. Water Supply. The water distribution system and the available water supply information must be obtained. Of particular importance are fire flow tests for the various areas of the installation. The results are used to compare the water system capability to the fire flow requirements. The data should include:

- Maps showing hydrant locations and flow capability, main size and connections.
- Distribution network.
- Remote locations that could require off-site Fire Department support.

Resources

- *firefighters & equipment*
- *storage/containment facilities*
- *water supply*

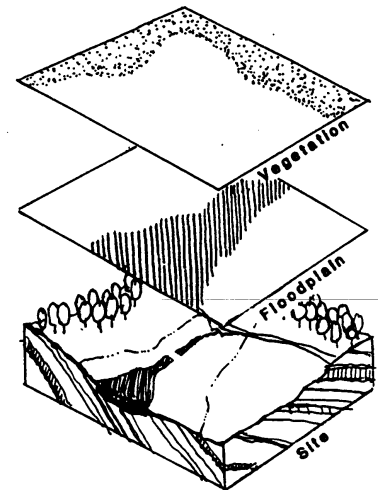
AFM 88-10 and TM 5-813 each contain several documents addressing "Water Supply". One aspect, estimating fire protection needs, is addressed in Appendix B.

2-8. Physical Data

a. Special Conditions. The environmental and physical makeup of the area should be included in the data collection effort (both with respect to natural and manmade barriers). This information is used by the planner to develop response contours for firefighters, develop future transportation networks and identify possible land use suitability.

- 1) Natural barriers (Figure 2-3). What are the weather characteristics and unusual climatic condition predictions, such as the magnitude of the 100-year storm, tornadoes, flooding, earthquake zones? The survey should identify if and how various sections of the installation are affected by weather phenomena such as by snow and snowdrifts. Is accessibility by fire department and emergency response personnel restricted? Do natural barriers include wooded areas, ecologically-endangered land or animal habitats? Are any mission-related functions affected in a manner important to rescue personnel? (For example, are vehicle test tracks and ranges impacted?)
- 2) Manmade barriers. These include walls, security fences, airfields and clear zones, ordnance storage and sites designated for hazardous chemical storage.

b. Land Use Data. The fire stations are normally located with respect to previous or current mission requirements. The fire station site(s) should be reassessed based on the mission areas currently in use, those planned for possible future use, and distances from other buildings on the installation. As new activities are added or tenants moved on the installation, the response priority system must be realigned and times and response needs reassessed.



Physical Data

Figure 2-3

c. High Hazard Facilities. These facilities should be clearly identified, and a clear distinction should be made between those in present use and those planned for future use. The information should be gathered and shown in relation to the transportation network on the installation and near the installation, and to other nearby unique/hazardous off-installation facilities. The siting considerations should also take into account the fire suppression measures and access requirements.

d. Each facility classification group generates different response requirements. Therefore, a "response time" map could be generated by the Fire Chief/Fire Marshal to identify the most appropriate fire station/emergency equipment locations to meet aircraft emergencies, and structural response time and distance requirements (Ref: AFR 92-1). This information is important to the planner for incorporation in The Plan.

2-9. Utility Data. As mentioned above, with respect to "resources," information regarding the utility distribution system networks should be part of the data collection activity. This information includes: locating the water lines on and near the installation, sources of water, main connections and sizes; local power grid networks; power sources (i.e. nuclear power plant, fossil fuel plants, hydroelectric plants, power lines) substation locations and; on-site back-up power/secondary power requirements and sources; gas lines, sources and connections. The planner through the Fire Chief/Fire Marshal needs to provide emergency power requirements to the utility engineers to assist them in locating power disconnects, fuel disconnects, isolation valves and alternative water supplies for use by emergency response teams.

Utility Data

2-10. Security Systems. Data collection and inventory must also include details of the electronic and physical security systems. It is important for the planner and fire protection specialists to understand the diversionary effects that may be deliberately generated in order to compromise the security of installation facilities.

Security Features

3

Defining the Fire Protection Situation

Chapter 3

Defining the Fire Protection (FP) Situation: Forecasting and Analysis

A. PURPOSE

3-1. Scope. Planning studies and analyses are performed to identify both current and future needs. This chapter provides assistance in identifying current problems and risks, forecasting future impacts on the current operations and planning, and developing alternative solutions (Figure 3-1).

B. FUNCTIONAL REQUIREMENTS FOR FACILITIES

3-2. Data Collection. During the data collection effort described in Chapter 2, the functional purposes of the surveyed facilities, both near-term and long-term, have been identified and categorized (in a manner probably similar to the method shown in Table B-2). The next step is to refine the categories, based on the specific installation and its mission(s), as well as social, economic and environmental considerations. This would be done by the planner with the assistance of the fire protection specialists on the installation and from the Major Command, as applicable. Once the categories have been redefined, the next effort is to assign each facility to its appropriate category. These initial efforts to categorize facilities are very important, because the data is used to help define the FP requirements for each occupancy category. Based upon the data collected, other tables would be generated for: installed fire suppression equipment; firefighting needs; personal protection required equipment; and procedures to be used in an emergency.

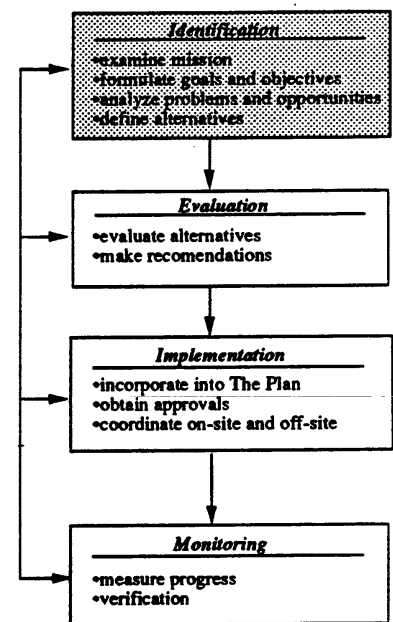


Figure 3-1

3-3. Application of the Data

The FP planning process includes the identification of problems, risks generated by the particular problem, and opportunities for the resolution of the problem(s). As indicated above the survey and the evaluation of the facilities must be done by someone experienced and knowledgeable in the FP field such as the Fire Chief/Fire Marshal and Major Command fire protection engineers (as applicable). By identifying the risks and problems, these fire protection specialists can determine gaps in the provision of current protection and project future requirements and alternatives. This information is then communicated to the planner for incorporation in the FP plan component of The Plan.

C. IDENTIFYING EXISTING PROBLEMS AND RISKS

3-4. Impact of Codes and Standards

a. Problems arise for many reasons. Sometimes they are caused by the expansion of existing DoD and national codes and regulations, and the addition of new codes and regulations to respond to technological advances or unique and/or new requirements. An example of a new standard that was promulgated to meet a special, non-technical need is ANSI A117.1. The ANSI code requires all new or refurbished buildings using federal funds to be usable by and accessible to the physically handicapped. If there is no entrance at ground level, it means that a code-conforming ramp is required and, in some instances, that elevators for accessibility to upper floors may be required. Also, these elevators now must have fire protection and safety features, such as a fireman's switch and an interconnection to the fire alarm system.

b. In some cases, technological advances and special requirements have made it necessary for the Army and the Air Force to establish more stringent requirements than called for in

Problems & Risks

- *codes & regulations*
- *changes in mission*
- *new technical requirements*

local and national codes. This occurs because standards, such as those developed by the National Fire Protection Association (NFPA) are consensus codes that usually state minimal requirements. Often, they are not the most appropriate code for special circumstances. The planner must include the Fire Chief/Fire Marshal of the installation, and Major Command fire protection engineers as applicable, early in the planning process in order to become cognizant of the appropriate guidelines in these areas. These design features may be given in the technical orders, regulations and the supplements.

c. National Fire Protection Association (NFPA) codes and standards have been updated to reflect the increase in technology and the understanding of the nature and propagation of fires. The NFPA 72 series, which covers the requirements for fire alarm detection and reporting systems, is an example. In facilities where alarms are required, the alarm system must be supervised. That is, trouble and/or faults are alarmed at a central facility so immediate maintenance can be performed to bring the detection and alarm system back on line. The requirements in the NFPA standards have become significantly more detailed in the recent revisions.

d. As the planner becomes aware of planned mission or facility changes, he/she should alert the fire protection specialists. This enables those concerned with FP to review requirements and anticipate potential problem areas. For example, converting a building such as a barrack to a nursery school or youth group center is not unusual. This means the fire protection requirements, including emergency exiting, would have to be reassessed and deficiencies identified.

***Changes in mission or use require
reassessment of fire protection
procedures/requirements***

e. Another example of re-examining facility fire protection requirements as a result of mission changes occurred at an Army post where testing of new weapon systems was to take

place. Test cells were added to a general maintenance facility to permit testing the engines of the MI and Bradley. A halon suppression system was incorporated in the test cell design in addition to the existing protection systems.

f. In addition many installations are in the process of upgrading their utility capabilities to accommodate new facilities, or meet projected industry demands in the ensuing decade. If, for example, a substation with increased capacity is to be built, it must now conform to the latest regulations and technical orders relating to fire protection at the time of contract notice to proceed. One of the governing codes is NFPA 70, National Electric Code. The planner should be familiar with some of the technical utilities factors that influence fire protection programs by working with installation engineers and other experts. For example,

- High voltage lines and units constitute a hazard to personnel. Their location should be kept away from heavy traffic, out of the landing field clear zone, and away from on-site housing and schools so as not to present an "attractive hazard".

Knowledge of the following design details, however, requires that the planner(s) rely on more technically experienced personnel as early in the process as practicable.

- Transformers cooled with PCB's are prohibited.
- Insulations that are low smoke and fire spreading (nonhalogenated) are recommended.
- Suppression requirements.
- Facility sizes and equipment location requirements.
- Dual feeders for better reliability.

D. ASSESSING DEFICIENCIES

3-5. Status. The output of the surveys provide the planner with the knowledge of the existing conditions and whether or not facilities comply with applicable codes and standards. Where there is non-compliance the planner should be aware of the cause of the deficiency: mission change, occupancy change, new technical requirements, or a code change, and their possible impacts on the mission. These data can be beneficial to the planner when examining FP requirements for expanded or new facilities. For example, non-compliance could be caused by new facilities that could result in insufficient water supply.

3-6. Potential Hazards

a. The responsibility for correcting and managing potential hazards is discussed in AFR 92-1 under the Fire Protection Program. A more complete discussion of risk and risk assessment contained is in Appendix C.

b. The planner must remain aware of the risks whenever examining present and future needs and the vulnerability and risk associated with the worst credible scenario. The records of like or similar situations are available at the safety data centers for each service and should be used as planning concepts are formulated. In planning, the WORST CREDIBLE OCCURRENCE must be used in order to accurately assess the maximum risks, and the means and costs to eliminate, control or mitigate the effects of the hazard risk.

c. The planner should contact the installation safety office for the status of the formal abatement plan and identified hazards under the risk assessment code (RAC) program, and the installation fire department for identified hazards under the fire safety deficiency (FSD) program (see Appendix C). Any open,

Risk Assessment

existing fire-life deficiencies should be noted. Fire protection personnel can assist the planner in identifying appropriate measures to bring retrofitted systems and facilities into compliance and features to be avoided in new design, installation and/or construction.

E. DEVELOPING ALTERNATIVES

3-7 Siting Alternatives

a. Normally more than a single alternative is available in solving problems and/or meeting needs. To develop meaningful alternatives requires creativity, imagination and an awareness of limitations imposed by the installation mission, socio-economic-environmental and physical constraints and FP constraints. The alternatives developed should solve the specific problem, consistent with the mission objectives and The Plan's goals and objectives. The alternatives may range from part of a major undertaking, such as constructing a new runway and support facilities, to an alternative that has relatively minor cost impacts such as providing code-conforming emergency exit signs in a place of assembly. An example is shown in Table 3-1: Problems and Alternatives. AFR 127-12 and AFR 92-1 provide techniques for prioritizing risks as a function of the cost of abatement, and these are discussed in more detail in Appendix C.

3-8. System Alternatives

a. The preferred method of resolving or abating potential system hazards is to eliminate their cause. However, this may at times be impossible or impractical. Determination of the method to be employed to reduce the likelihood of their occurring can be made by conducting a thorough analysis and by considering the possible trade-offs between various system alternatives. The

TABLE 3-1: PROBLEMS AND ALTERNATIVES

PROBLEMS

- The final approach brings aircraft in over heavily congested areas. Some of the pilots who use the field are from Guard units and are receiving weekend training. Others include behind-the-line rated personnel maintaining flight proficiency, and foreign pilots not fully familiar with the field and U.S. military flight procedures.
- The tower capabilities cannot handle the increased air traffic as effectively as desired. Influencing factors include the age of the tower equipment, amount and type of traffic, tower personnel training and the weather.
- The aircraft fuel lines were laid beneath the existing runway, connecting hangers and refueling facilities on both sides of the field. The initial construction did not provide for isolation valves at each side, which would enable the firefighters to isolate each side of the field, lines and fuel source in the event of fire or crash.

RISKS

- The risk associated with each of the above problems becomes evident. Statistically, the majority of aircraft accidents occur on take-off and landing, with the population under the flight pattern and in the area at risk. The probability of occurrence of an accident will be increased because of the training mission aspects, and the use of the field by foreign pilots.
- An increased tower workload with dated equipment creates another type of risk.
- The inability to isolate the fuel and stop fuel flow in the case of a fire is another risk.

FUTURE ACTIVITIES

- Future plans show a significant increase in air traffic, involving many different types of aircraft such as transports and jet fighter-bombers. The airfield is not capable of accommodating many of the newer types aircraft. Therefore, in order to handle the increased runway length requirements and new storage and maintenance needs, the runway must be relocated in order for it to be lengthened and allow additional support facilities to be constructed.
- Additional missions requiring experienced, technical support will be added. This will require more facilities and family housing, which will impact the available water supply as well as sewage and electrical demands.

ALTERNATIVES

- The new runway can be aligned so as to include a clear zone in compliance with current regulations, thereby reducing the risk to congested population areas.
- As part of the new runway construction, isolation valves can be installed. As the concept proceeds, fire protection criteria would address the following type of requirements: locate valves clear of or protected from aircraft and vehicular traffic; valves must be clearly identified; valves must be installed with tamper annunciation; and the installation should provide ease of inspection, servicing and maintainability.

- The tower design can be upgraded, with latest proven equipment, and include training for the tower operators on the new equipment.
- The abandoned runway could be used for new facility and housing parking, or roadways. Existing hanger facilities may still be usable for maintenance and storage.
- With the new construction the planner can codify mission and functional operations more effectively. As an example, the Guard units and their support facilities can be selectively located, as can other flying and support organizations.
- The fire stations were probably located to serve the replaced runway. Relocating the firefighting facilities also should be considered in order to quickly and safely respond to crashes and facility fires.

philosophy dictating these analyses, which includes consideration of the security system guidelines and standards, should result in the resolution of alternatives. MIL-STD-882B specifies actions to satisfy such requirements in the following order of precedence, known as the system safety precedence (Figure 3-2):

- 1) First - Eliminate or control the hazard through engineering
- 2) Second - Use of safety devices
- 3) Third - Use of warning devices
- 4) Fourth - Develop special safety procedures

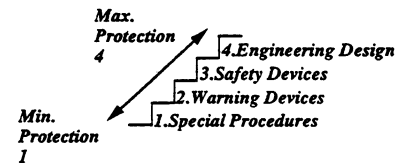


Figure 3-2

b. Prior to any discussion of the use of precedence for the control of system hazards, the planner must remain aware of the inherent need in basic design for consideration of human limitations as a design constraint. The frequency of occurrences of accidental behavior which results in damaged equipment or personnel injury is directly related to human errors that might be committed during the operation and maintenance of equipment. General knowledge about human errors permits the reduction of these occurrences by imposing appropriate human factor constraints on system design. The choice of method to be used to resolve or minimize the effects or occurrence of a potential hazard may be dictated by design complexity, operational requirements, economic restrictions, or other factors.

- 1) Eliminate or control the hazard through engineering design or redesign. The probability that the system will enter a hazardous mode can be reduced or minimized during design or redesign, depending on the system design function, by considering the following:
 - Fail-safe features are incorporated to cause the system to transfer from a high loss or risk mode to a lower loss or risk mode, upon the occurrence of a component failure. The inclusion of a fail-safe device does not reduce the probability of occurrence of failure, but alters the nature or magnitude of the loss or risk.

- Redesigning for high system reliability. The frequency of occurrence of a failure can be reduced by increasing component reliability. High reliability can be a function of such factors as the design of the components, the manufacturing process, the degree and type of quality control, and the length of component storage in relation to its shelf life.
- 2) Use of Safety Devices. Safety devices are incorporated to reduce the magnitude of the loss or risk once a hazardous mode has occurred. These include such devices as interlock switches, protective enclosures and safety pins. For example, safety pins are used on ejection seats during maintenance to reduce the hazard of inadvertent activation. Another example is the use of Halon systems in computer rooms to suppress fires without damaging equipment or creating a major cleanup problem. Care must be taken to ensure that the operation of the safety device reduces the loss or risk and does not introduce an additional hazard.
 - 3) Use of Warning Devices. Failure warning devices or systems are audio-visual, portion where the human is the responder. The effectiveness of any failure warning system is dependent upon the human's ability to perceive and react in the most appropriate manner in a timely fashion. Smoke detectors found in most facilities (e.g., troop and family housing) are typical of such warning devices.
 - 4) Use of Procedures and Training. The frequency of occurrence of a hazardous event can be reduced by good operating procedures that are properly enforced, and through use of a well-defined training program on the operating procedures. Where it is not possible or practicable to eliminate or adequately control a hazard through design, selection or use of safety and warning devices, procedures and training are used to control the hazard. However, procedures are the least preferred solution to abating a hazard.

4

Evaluation and Recommendation

Chapter 4

Evaluation and Recommendation of FP Plan Alternatives

A. PURPOSE

4-1. Context

a. The next step in the fire protection planning process includes evaluation and recommendation. The evaluation phase is an examination of each fire protection alternative and how well it meets the future mission and installation needs. The recommendation phase identifies and recommends "preferred" alternative(s) as determined through selection criteria (Figure 4-1).

b. It is important to recognize that there are no absolutes in resolving problems, only compromises that provide the best balance between the essential factors of mission accomplishment, the installation's goals and objectives, and the protection and preservation of mission capability life and property. All must be considered in the context of the complete comprehensive planning efforts on the installation.

B. SELECTION AND APPLICATION OF CRITERIA FOR MEETING THE GOALS AND OBJECTIVES

4-2. Selecting the Criteria

a. At this point in the process, the planner is aware of the current and future Fire Protection (FP) problems that exist on the installation, and the magnitude of the risk if no action is taken to eliminate, control or mitigate it. The next step is to formulate and apply criteria for measuring the effectiveness of the alternatives. The number of criteria for evaluating different conditions can vary.

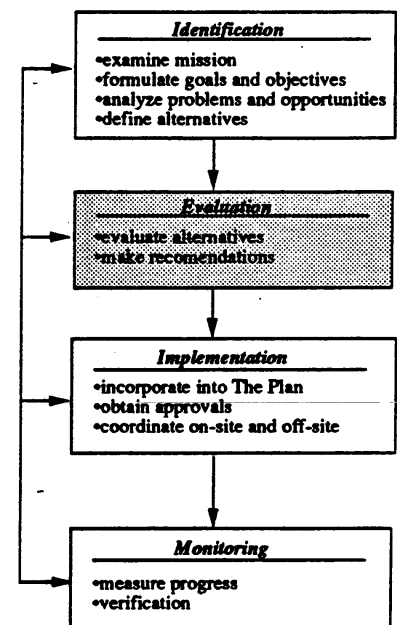


Figure 4-1

The planner should anticipate that the FP specialists who will perform the evaluation have considered, at a minimum, the following five criteria:

- Meeting the Goals and Objectives
- Risk Reduction
- Life Cycle Costs
- Conformance to Codes
- Environmental Impact

Evaluation Criteria

b. Meeting the Goals and Objectives. Each concept and alternative developed should meet the goals and objectives set forth in Chapter 2. If there is a change in the objectives, reevaluation is necessary.

Meet Goals & Objectives

c. **Risk Reduction.** As discussed in Chapter 3, severity and probability are used to develop a risk assessment factor. Another factor, time of exposure, is also considered if applicable: the exposure to the risk may be present during specific actions or during a phase of an operation. For example, engine and electrical fires involving the Army's combat vehicles are a major concern. An electrical fire in a tank poses a serious threat to life and a potential loss of equipment and mission capability. To reduce the risks, Halon 130 nozzles are installed in several locations in the crew compartment, and Halon 2402 is being investigated as a means to control engine fires. Aircraft are equipped with fire suppression systems in the engine, again to reduce the loss potential of valuable resources and human life. As another example, the greatest risk to an aircraft and its crew occurs during takeoff and landing, with only minimal comparative risk occurring during flight. Therefore, the programmatic emphasis on safe operations and control must focus the hazards and risks present at takeoff and landing, and the means to mitigate the risk or control it, if it does occur.

Risk Reduction

d. **Life Cycle Costs.** The estimated costs to control or mitigate the hazard or risk must be part of the evaluation process. If costs are difficult to quantify, the cost-benefit analyses can include ratioed values for prioritizing alternatives. One of the techniques used in fire protection planning is looking at the ratio of the loss due to an accident/incident (for the worst credible scenario) to the cost to eliminate, control or mitigate the hazard or risk (Figure 4-2). This ratio is then used to help determine how the greatest dollar return can be realized. As an example, consider an accident cost with and without a design change. Based on the expected system/facility life and an opportunity cost, a determination is made as to whether the change is a good investment versus another technique or design. Factors such as compassion and public opinion are not reducible and must be examined differently. When estimating the range of costs for each alternative, both capital and operating and maintenance (O&M) costs should be included in the estimate:

Life Cycle Costs

- 1) Capital costs are usually more easily estimated than O&M costs as they tend to be one-time expenditures based on prior experience. However, the peripheral impacts should be considered when estimating the capital costs. As an example, if a new runway is to be constructed to accommodate newer aircraft, the planner should be aware of the other costs, such as the new maintenance requirements (facilities, stores, POL, and refueling areas) to handle the aircraft. During the initial design phase, detailed costs are not required. The "takeoff" costs are only performed once the design has been developed. As another example, planning to increase the targeting capability of self-propelled field artillery units requires additional, complex and expensive drive, slew and stow mechanisms. Special, fire-protected facilities for maintenance and storage of the new equipment as well must be included in the project cost.
- 2) The O&M costs include: maintenance costs such as inspection, servicing, provisioning; maintenance personnel salaries and their training; operating costs such as operating special support, personnel salaries and training; costs per operating hour of equipment supporting mission requirements; and the day to day miscellaneous expenditures. The O&M costs can be estimated using compatible

Capital Costs

O&M Costs

industry operations, but any assumptions made need to be clearly defined for future comparisons and use.

e. Conformance to Existing Regulations, Technical Orders, Codes, Standards and Publications and Security Guidelines. As was discussed in the previous Chapters, there are several factors that underlie the need to meet the latest FP requirements/recommendation:

Conform to Existing Codes

- 1) The increasing technological advances that have increased system complexity
- 2) Increased specialization
- 3) A better understanding of hazards and risks and improved analytic techniques
- 4) Increased costs of weapon systems and their support requirements whereby any loss or reduced availability can adversely impact mission performance
- 5) The increased concern for protection and preservation of human life

f. **Environmental Impact** When evaluating alternatives, it may be necessary to address the effects of the fire protection measures on the environment. For example, automatic fire detection and suppression systems are required at hazardous waste storage facilities. If a sprinkler system is installed, water containment may be necessary to prevent the accumulated liquids from flowing away from the site and contaminating adjacent areas.

4-3. Applying the Criteria

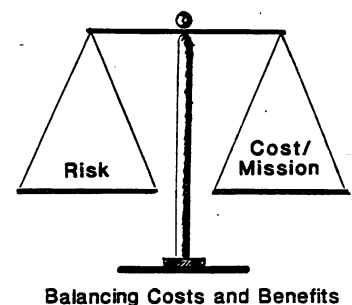
a. The preferred precedence for resolving problems is the system safety precedence, discussed in Chapter 3. In summary, the system safety precedence emphasizes that the lower the solution falls on the precedence ladder, the less desirable the solution is from a fire protection perspective (and often for overall operational effectiveness).

b. Quantitative assessments enable the planners to prioritize the alternatives in terms of the five criteria:

- 1) Meeting Goals and Objectives
- 2) Risk Reduction
- 3) Life Cycle Costs
- 4) Conformance to Codes
- 5) Environmental Impact

Where factors, such as political and public opinion, and environmental protection are considerations, the planner should identify and present a summary of concerns and risks. The assumptions used for selecting criteria should be detailed in the analysis for future reference especially when there are modifications to the mission, goals, policies and objectives.

In addition, the planner should fully coordinate his conclusions with the fire protection planning specialists, engineers and security officials to avoid unnecessary disruption, or non-FP compliant proposals being recommended for action.



4-4. Making Recommendations

a. After each alternative has been evaluated using the selected criteria, they should be prioritized, with ranked choices. This enables the various factors to be discussed and the resulting compromise assessed prior to a final decision. Each factor can be compared on a line-by-line basis, and judgments made based on accepted and proven techniques. Table 4-1 is an example of how to display the summary of alternative rankings.

b. Having completed the evaluation, the planner with technical assistance will need to identify the preferred alternative(s). The plural is used, because it is possible that within a complex

Table 4-1

Alternative Evaluation

Alternative Evaluation	Alternatives	Criteria	Status Quo	Future Plan	Alternative #1	Alternative #2
Meets Objectives						
Risk Reduction						
Life Cycle Costs						
Conformance						
• Egress						
- no. of exits		3	1	2	2	
- travel distance		3	1	2	2	
- route safety		3	2	3	3	
- emergency power		2	2	2	2	
- emergency lighting		3	2	2	2	
Environmental						

[example alternative evaluation]

Ratings

- 1 - exceeds the criteria
- 2 - meets the minimal requirements
- 3 - does not meet the minimal requirements

problem there are several actions that must be taken, that may involve the installation and the community. Each - recommendation should detail the advantages and disadvantages of the preferred alternative. The recommendations should be presented for both near-term and future fire protection considerations.

5

Community Relations

Chapter 5

Community Relations

A. AGREEMENTS OF UNDERSTANDING WITH LOCAL AGENCIES

5-1. Alternatives

a. Designing to handle all possible catastrophic or near catastrophic events can place a severe strain on the capabilities of the installation firefighters, medical personnel and other emergency response teams. For example, if a hazard has a probability of occurrence that is "REMOTE", the evaluation of providing a full on-site response capability could reveal very high costs and underused FP facilities, equipment and personnel. An alternative may be to seek and use off-installation support (Figure 5-1).

b. Military installation commanders are encouraged to enter into reciprocal agreements with the community for mutual firefighting assistance (DoDI 6055.6). And, a portion of the required fire protection may be provided under such an agreement.

5-2. Benefits

a. The benefits of such an agreement can be realized in many ways, one being fire equipment support. For example, assume that in the community adjacent to the installation, there is a fire department with a "heavy" response capability (necessitated by the industry in the local area). Through mutual support agreements, the off-site fire departments could respond on second alerts, or when notified by the installation's 911 desk. The same rationale can be applied to community medical facilities and personnel, and local enforcement agencies.

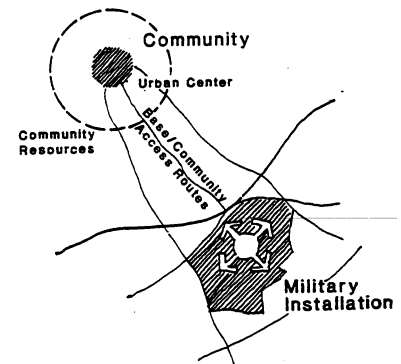


Figure 5-1

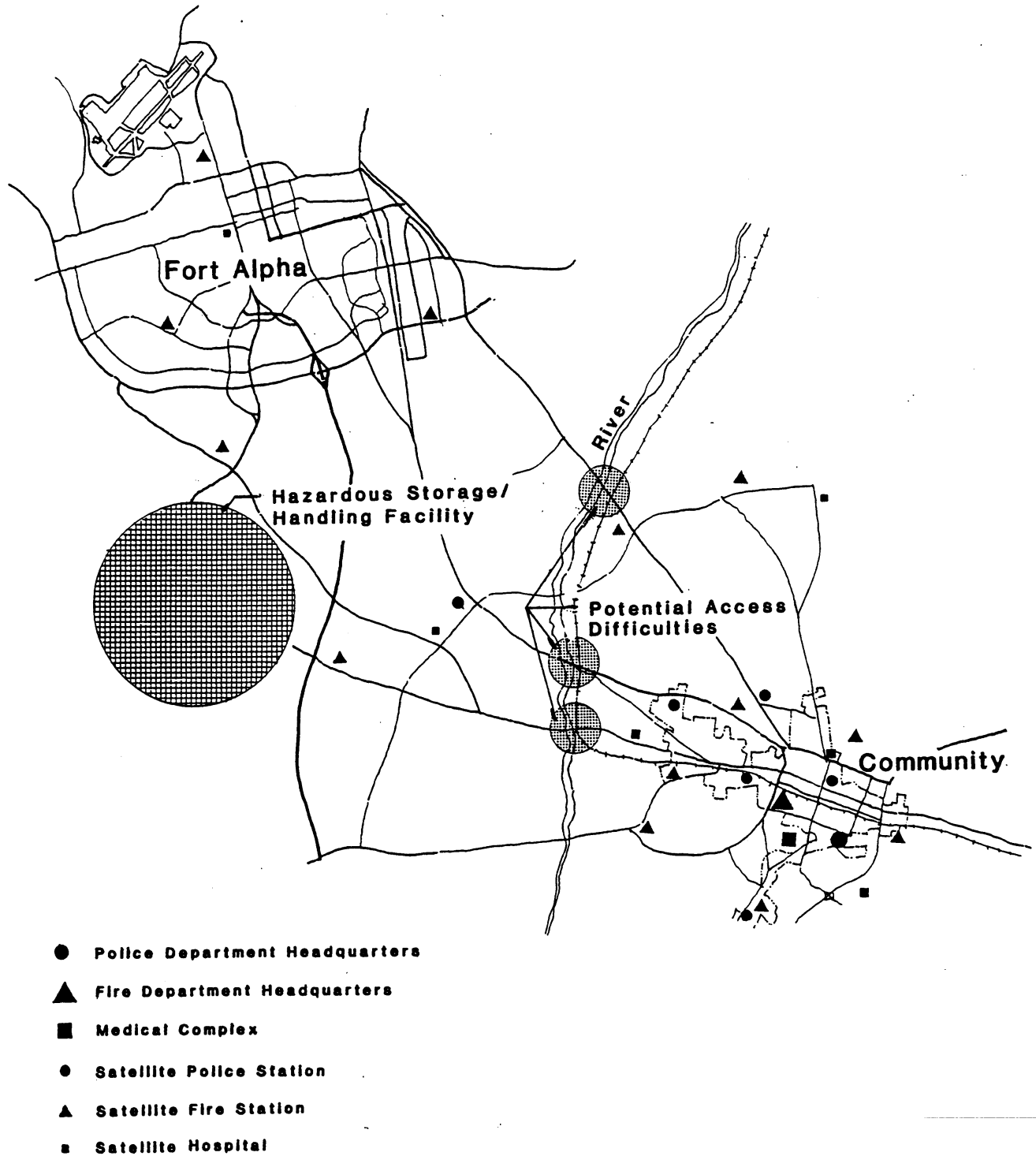
b. Likewise, single or multiple incidents off the installation may result in the installation's firefighters responding to a community emergency. Benefits to the installation include improved community relations, possible enhanced protection of military facilities and personnel, additional training through joint training exercises and experience. Mutual agreements can be especially beneficial to both the installation and the community when remote installations are constructed and the community gradually develops around the installation. Initially, much of the support in emergencies may be provided by the installation through mutual agreement. As the community continues to grow, the relationships and the mutual assistance agreements can be expected to change.

c. An example of mutual support between several civilian jurisdictions and the military occurred as a result of a railroad collision between Conrail locomotives and an Amtrak passenger train. Local medical facilities were inadequate to handle the number of injuries. Medical facilities from a nearby Army post were made available, as were Army personnel, to help control the scene and assist as required in the event of the release of toxic materials.

d. Figure 5-2 is an example of a mutual firefighting assistance map which depicts locations of key emergency response and medical facilities. The map may be used to identify resources, firefighting capabilities and fire access routes. When some routes are susceptible to obstructions, these should be noted so suitable alternate routes can be selected as required.

B. EMERGENCY PLANNING

Normally, broader agreements are also developed between state and local agencies or national guard units. These issues/arrangements are addressed in contingency planning bulletin/manuals.



Community-Installation Emergency Response Resources

Figure 5-2

6

Implementing and Monitoring The Plan

Chapter 6

Implementation and Monitoring

A. IMPLEMENTATION

6-1. Purpose. During the implementation phase of the comprehensive planning process, plan alternatives are selected, long-term construction projects are programmed and required improvements in services and facilities are initiated (Figure 6-1). The land use, transportation and utilities plans are particularly key elements in the process. In this regard, fire protection considerations must be reflected in the initial planning phases of these plans as well as in their final recommendations for installation development. As such, there are three elements of the fire protection implementation process:

- Incorporation into The Plan
- Obtaining approvals
- Coordination

6-2. Incorporation into the Base/Installation Comprehensive Plan (The Plan)

a. Fire protection standards regarding facility design and siting must be incorporated into the land use, transportation and utilities planning processes as early as the identification phase. Knowledge of fire protection facility access requirements, siting requirements (response curves/distances and hazard zones) and capacity requirements (water flows) at this early point in the process will enhance the development of realistic alternatives.

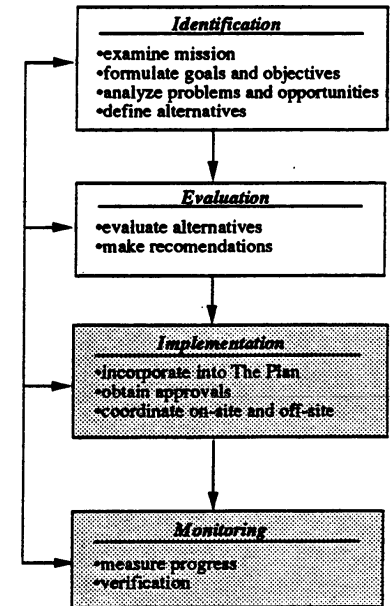


Figure 6-1

Incorporate into The Plan

b. Fire Protection measures are used to assess the merits of the various plan alternatives as well as to provide recommendations of alternative methods for achieving the required standards.

6-3. Obtain Approvals. Having established priorities, approval of the plans and required funding is necessary. The recommendations presented must be suitable to the installation's needs, and be feasible. Again, the FP plan is not prepared as an independent activity; it is an integral part of The Plan. The implementation of fire protection measures in installation projects can have a profound and long-lasting impact on system performance, schedule and costs. While costs tend to be a major consideration in the planning and decision making process, because of the importance of the FP support effort to the overall plan they cannot be unilaterally reduced or modified by other planning activities.

Obtain Approvals

6-4. Coordination. In Chapter 1, key personnel and their roles in the planning process were discussed. Each individual makes an important contribution because his/her inputs stress special needs, and provide a particular perspective towards the mission role. Coordination with these on-site disciplines is required, and it is also important to include the adjacent community(ies) in the coordination process. Each civilian community usually prepares its own Capital Improvements Program (CIP) with both near-term and long-term goals. To the degree possible, the installation and community CIPs should be compatible. An example of mutual interest is adequate installation accessibility for the work force and off-site emergency response teams.

Coordination

B. MONITORING

6-5. Measuring Progress. The tracking of fire protection project(s) can be accomplished by comparing the actual progress to the installation's CIP. However, there are critical points in the

Measure Progress

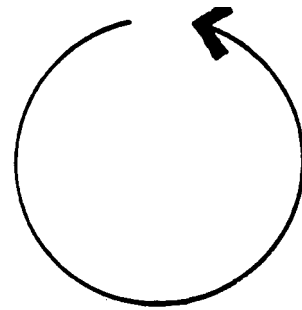
review process where adherence to the criteria can be determined, such as during as design reviews and/or construction.

Verification

6-6. Verification

a. The purpose of this step is to evaluate the effectiveness of the implemented activities and design features, and adherence to policy and procedures. The FP process should be thought of as a closed-loop process, whereby there is continuous feedback to the planner, who receives input from and provides the results to the other installation planners and concerned personnel. It may become necessary to modify design approaches and proposed solutions to perceived hazards and risks because of other factors that had not been recognized, or are more critical than originally thought. Regardless, the planner must be prepared to adjust the plan. When there are changes it is vital to reassess their impact on the established fire protection criteria. If analyses were performed, they also must be reexamined for the effects of the changes.

Feedback Loop



b. The ultimate test of any plan is the extent to which the installation applies it on a continuing basis to guide installation development. The fire protection plan must be relied on for providing facility design and siting requirements, enhancing the functional efficiency of installation development, and improving the quality of life of installation residents and employees.

Adhering to The Plan

Appendix

APPENDIX A. REFERENCES

Department of Defense Instructions(DoDI)

DoDI 6055.6	Department of Defense Fire Protection Program
DoDI 1000.3	Safety and Occupational Health Policy for the Department of Defense

Air Force Regulations(AFR) and Manuals(AFM)

AFR 18-1	Air Force Energy Management
AFR 19-8	Environmental Protection Committees and Environmental Reporting
AFR 19-14	Management of Recoverable and Waste Liquid Petroleum Products
AFR 55-14	Operational Procedures for Aircraft Carrying Hazardous Material
AFR 55-42	Management and Use of Aircraft Arresting systems
AFR 60-1	Flight Management
AFR 60-5	Air Traffic Control Management
AFR 60-11	Aircraft Operations and Movement on the Ground
AFM 85-16	Maintenance of Petroleum Systems
AFM 86-2	Standard Facility Requirements
AFR 86-4	Base Comprehensive Planning
AFR 86-14	Airfield and Heliport Planning Criteria
AFR 87-5	Establishing, Accounting and Reporting Real Property
AFM 88-10 CH6	Water Supply for Fire Protection
AFM 88-15	Air Force Design Manual - Criteria and Standards for AF Construction
AFM 88-19 CH3	Runway and Road Design
AFR 91-26	Maintenance and Operation of Water Supply, Treatment and Distribution Systems
AFR 92-1	Fire Protection Program
AFR 93-2	Contingency Response Planning
AFR 127-12	Air Force Occupational Safety, Fire Prevention, and Health (AFOSH) Program
AFR 127-100	Explosive Safety Standards

AFR 208-1 The U.S. Air Force Antiterrorism Program

AFR 355-1 Planning and Operations

Air Force Tables of Allowance(TA)

006 Organizational and Administrative Equipment

008 Civil Engineer Equipment

012 Vehicles

016 Special Purpose Clothing and Equipment, USAF

490 Civil Engineering Fire Protection, Support and Aircraft Crash Rescue Equipment

660 Communications Equipment for Non-Communications Activities

Air Force Technical Orders(AFTO)

00-25-172 Aircraft Movement and Placement of Vehicles

00-25-212 Static Electricity and Stray Currents in Air Force Refueling Systems

13 Category Aircraft Furnishing, Cargo Loading and Aerial Delivery and Firefighting Equipment Publications (for certain types of fire extinguishers and other publications as required)

14 Category Deceleration Devices, Personal and Survival Equipment Publication (for protective clothing and other publications, as required)

15 Category Aircraft and Missile Temperature Control, Pressurizing and Air Conditioning, Heating, Ice Eliminating and Oxygen Equipment Publications (for breathing apparatus and other publications, as required)

35 Category Ground Handling Support, Air and Missile Base Operating Equipment Publications (for runway barrier, fire extinguishers and other publications, as required)

42 Category Chemical, Oxygen Metal, Textile, Fuels, Cordage, Lumber and Rubber Materials (dopes, cleaning compounds, glues, gases, lubricants, paints, plastics, etc.). Publications (for information and guidance on hazardous materials and other publications, as required)

11A-1-46 Firefighting and Withdrawal Time, Distance, and Related Criteria for Explosives (except nuclear weapons)

11N-20-11(c) Precautionary Measures for Aircraft Carrying Hazardous Cargo (Title Unclassified)

Army Relations(AR)

AR 95-50	Airspace and Special Military Operation Requirements
AR 200-1	Environmental Protection and Enhancement
AR 200-2	Environmental Effects of Army Actions
AR 210-5	Planning Procedures for Construction Projects in the National Capital Region
AR 210-11	Installation Billeting Operations
AR 210-20	Master Planning for Army Installations
AR 210-70	Intergovernmental Coordination of DoD Federal Development Program and Activities
AR 385-60	Coordination with Department of Defense Explosive Safety Board
AR 385-63	Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat
AR 190-13	The Army Physical Security Program
AR 405-15	Inventory of Army Military Real Property
AR 415-28	Department of the Army Facility Class and Construction Categories (Category Codes)
AR 420-40	Historic Preservation
AR 420-74	Natural Resources; Land, Forest, and Wildlife Management

Army Technical Publications

TM 5-800-1	Construction Criteria for Army Facilities
M-5-803-2	Environmental Protection Planning in the Noise Environment
TM 5-803-4	Planning of Army Aviation Facilities
TM 5-80307	Civil Engineering Program: Airfield and Heliport Planning Criteria
TM 5-811-1	Electrical Power Supply and Distribution
TM 5-813-1	Water Supply, General Consideration
TM 5-822-2	General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas
TM 9-1300-206	Ammunition and Explosives Standards

Commercial Publications

National Fire Protection Association Codes, and other publications, National Fire Protection Association, Boston, MA

Military Publications

MILSTD 756	Reliability Prediction
MILSTD 781	Reliability Tests
MILSTD 882	System Safety Program Requirements
MILHDBK 1008	Fire Protection for Facilities Engineering, Design, and Construction

APPENDIX B

COLLECTING DATA AND PERFORMING SURVEYS

Performing Facility Surveys

Normally the Fire Chief/Fire Marshal performs a facility survey to assess the fire protection features and level of compliance to fire protection codes, -standards and directives. It is important that- the checklists or survey forms used adequately cover all aspects of -the fire - protection needs. The methodology employed must provide a clear picture of the facility's:

- Age
- Construction
- Occupancy and potential for other occupancies
- If multiple occupancy, the different types and governing factors
- Fire protection features in place
- Current and future requirements

Table B-1 is an example of-the types of fire protection features and requirements that should be inventoried. The example shown is for places of assembly, such as the commissary, movie theater, chapel and the officers and-enlisted-clubs.

Table B-2 is an example of a checklist which extracts the-information from-Table B-1 and establishes the fire protection requirements to be inventoried.

Tables B-3, B-4 and B-5 are examples of the detailed checklists used to determine the status-of-the fire protection features at each facility such as-at facilities requiring automatic sprinklers,-protective alarm systems and halon systems.

TABLE B-1
EXAMPLE OF FIRE PROTECTION FEATURES TO BE SURVEYED
FOR PLACES OF ASSEMBLY

Area:	General area limitations Area exceptions Fire lanes
Height:	General height limitations Height exceptions
Limiting Internal and External Fire Spread:	Walls to limit maximum foreseeable loss Fire partitions Physical Separations between facilities Protection of openings in walls and floors Rating of floor/roof assemblies
Occupancy and Construction:	Classification of occupancy Hazard of contents Type of construction (NFPA 220) Wall construction Floor construction Roof construction and covering Balconies, mezzanines construction Stages and platform construction Outdoor assembly construction Food-preparation area Rubbish handling Projection room Hobby, craft, exhibition area
Interior finish:	Interior finish and trim Application of interior finish Flame spread and smoke development tests Furnishings and decorations

Table B-1 Continued

Means of egress:	Occupant load and location Capacity of means of egress Number of exits Exit access corridors Grade passageways Horizontal exits Interior exit stairways Access to roof Marking of means of egress Means of egress lighting Elevator, exit restrictions Smokeproof enclosures Exterior exit stairways Panic hardware Security system devices Security hardware
Fire protection:	
Suppression	Standpipe systems and fire department connections Water supply
Detection	Automatic fire detection,-alarm, and communication systems Manual fire alarm system
Vertical openings:	Stairways Elevator opening protection Firestopping Vertical shafts, chutes and hoistways Open wells and atriums
Hazards:	Boiler and equipment rooms Storage space, site Plastics Inspection of hazardous uses Cooking space Paint shop
Light and ventilation:	Toilet rooms Ventilation of shafts Light and ventilation Air conditioning, refrigeration and mechanical ventilation
Provisions for the handicapped and aged:	Reference: ANSI A 117.1 Ramps Bath and toilet rooms Elevators
Source:	BOCA NFPA 101

TABLE B-2
IDENTIFYING FP REQUIREMENTS FOR FACILITIES

FIRE PROTECTION REQUIREMENTS

Bldg. No.	Const. Type	OCC Cat.	Exits	Detect. Alarm	Stand Sprink.	Fire Sep.	Assmb.	Dist. Sep.	Supp.
--------------	----------------	-------------	-------	------------------	------------------	--------------	--------	---------------	-------

Abbreviations

Bldg. No. -	Building number
Const. Type	Construction type
OCC Cat.	Occupancy category
Exits	Emergency exitways
Detect. Alarm	Automatic detection and alarm system
Stand/Sprink.	Standpipe system and/or sprinklers
Fire Sep.	Fire rated separations
Assmb.	Vertical opening assemblies
Dist. Sep.	Distance separating facilities
Supp.	Suppression system, -such as Halon, carbon dioxide or dry chemical

TABLE B-3

Example: For buildings requiring sprinklers: (Ref: NFPA 13, Sprinkler Systems)

Bldg. No.	Const. Type	OCC Cat.	Haz. Cat.	Floor Area	Area Provided	Complies Yes No
--------------	----------------	-------------	--------------	---------------	------------------	--------------------

TABLE B-4

Example: For buildings requiring automatic or manual fire alarm systems (pull stations), Ref: NFPA 72A,-Local Protective Systems)

Bldg. No.	Const. Type	OCC Cat.	Haz. Cat.	Floor Area	Area Provided	Complies Yes No
--------------	----------------	-------------	--------------	---------------	------------------	--------------------

TABLE B-5

Example: For-buildings requiring Halon Systems

Bldg. No.	Const. Type	OCC Cat.	Haz. Cat.	Floor Area	Area Provided	Complies Yes No
--------------	----------------	-------------	--------------	---------------	------------------	--------------------

* References: NFPA 12A, Halon 1301 Fire Extinguishing Systems
NFPA 12B, Halon 1211 Fire Extinguishing Systems
NFPA 12C - Tentative, Halon 2402 Fire Extinguishing Systems, 1983

Estimating Future Requirements

The -fire.-protection and utility specialist must carefully forecast future requirements using recognized and established procedures. Table B-6 is an example of the elements that comprise an estimate on future water requirements-and Table-B-7-is an example of a checklist to inventory-current capabilities.

TABLE B-6

Example: Estimating Water Storage Requirements (Ref: TM 5-8134/AFM 88-10)

1. Water Sources
 - 1-1 Municipal
 - 1-2 Wells
 - 1-3 Other sources
 - 1-4 Resupply-under assumed emergency conditions -
2. Water Supply Available -
3. Per capita Requirements
 - 3-1 On-site Residents
 - 3-2 Employees
4. Domestic Demand and Rate
5. Average Daily Industrial Consumptions
6. Fire Flow
 - 6-1 Maximum Fire Flow Rate
 - 6-2 Maximum Fire Duration
7. Requires Water Storage Capacity (Function of 4, 5, 6, 1-4)
8. Provided Water Storage
- 9a. Fractional Excess
- 9b. Fractional Deficiency

TABLE B-7

Example: Estimating Required Water Fire Flows (Ref: TM 5-813/AFM 88-10)

Occupancy
Category

		Bldg. No.	Max. Fire Flow	Req'd. Flow	Measured Flow	Complies Yes No
1.0	Places of Assembly					
1-1	Church					
1-2	Chapel					
1-3	Gymnasium					
1-4	Theater					
1-5	O'Club					
1-6	NCO Club					
1-7	EM Club					
1-8	Drill Hall					
1-9	Youth Center					
2.0	Medical Facilities					
2-1	Hospital					
2-2	Dental Facility					
2-3	Ambulatory Care Facility					
3.0	Housing					
3-1	Troop Housing					
3-2	Family Housing					
3-3	Guest Quarters					
4.0	Aircraft Support					
4-1	Maintenance					
4-2	POL Storage					
4-3	Hangers					

Table B-7 (Continued)

Occupancy Category		Bldg. No.	Max. Fire Flow	Req'd. Flow	Measured Flow	Complies Yes No
4-4	Storage					
4-5	Parking					
4-6	Control Tower					
5.0	High Risk					
5-1	Munition Storage					
5-2	- Refueling and Storage					
5-3	Test Range					
5-4	Laboratories					
5-5	Spray Booths					
5-6	Processes					
5-7	Ordinance Process					
6.0	Admin Facilities					
6-1	Headquarters					
6-2	Personnel/Finance					
7.0	Fire Station					
8.0	Mercantile Facilities					
8-1	Commissary					
8-2	Exchange					

Defining Current Capabilities

The fire protection specialist must also look at the various systems that support and are an integral part of the fire protection program. These include:

- Fire detection and alarming systems
- Control systems, such as for ventilation
- Communication networks

Table B-8 is an example of a checklist that can be used to determine current network-capabilities based upon existing requirements.

TABLE B-8
FIRE AND CRASH RADIO NETWORKS

The following is an example of a communications network for fire protection that must be coordinated with the communications experts.

	TRANSCEIVER TYPE	LOCATION/USER	REQUIRED	PROVIDED
1.	Base Station	Located in Fire Alarm Center		
2.	Mobile	Fire/crash vehicle subject to emergency response Installation Engineer (Fire Marshal) Crash ambulance		
3.	Portable	Per TA 660/Installation Fire Department Remote fire station in excess of 5 miles from main station		

TABLE B-8 (Continued)

FIRE AND CRASH RADIO NETWORKS

	TRANSCEIVER TYPE	LOCATION/USER	REQUIRED	PROVIDED
4.	Remote	Fire station		
		Control tower		
		EOD control office		
5.	Others			
	TOTALS			

APPENDIX C. RISK ASSESSMENT

1. The steps in risk assessment include:
 - Identify the hazard
 - Analyze the hazard
 - Resolve the hazard
 - Verify the adequacy of the corrective action.

Hazards and risks are then categorized as to their potential severity should an accident or incident occur, and their probability of occurrence.

2. Those risks considered most severe (or catastrophic in some analyses) are those that:
 - (1) Result in death or multiple severe injuries.
 - (2) Result in loss of a system or severe impact on mission performance.
 - (3) Cause unacceptable delays in operations, testing or other areas.
 - (4) Result in a significant monetary loss.

The less severe risks -are also defined as a function of injury to personnel or the public, damage to equipment, loss of mission performance capability, effect-on operations and testing and often replacement costs.

3. Probability of Occurrence. The frequency that an event can be expected to -occur is normally determined by historical records, operational experience and prediction based upon performance parameters. The- planner is cautioned NOT to -rely upon his/her personal experience or that of others exclusively, when determining these probabilities. The safety-data centers have excellent information with retrieval available on short notice.
4. There are two fire safety matrices used to determine the level of the fire risk/hazard. One is the Fire Safety Deficiency (FSD) matrix; and the other is the Risk Assessment Code (RAC); the RAC is used primarily for occupational and health hazards, but is also used to assess fire hazards not specifically covered by the FSD.

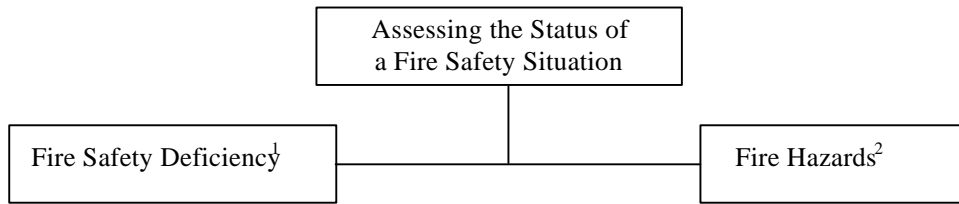
Figure C-1, Assessing the Status of the Fire Safety Situation, depicts how the planner/fire prevention -planner determines which matrix, the FSD or RAC, is most appropriate for a given situation.

- 4.1 Risk Assessment Code (Reference APR 127--12). Every- deficiency or hazard -identified must be assigned a risk assessment code or RAC. The RAC is based upon the severity of the hazard consequences, and the probability of occurrence, or mishap probability(an example follows in Table C-1.) RAC's designated I, 2, or 3 that require more than 30 days to control/mitigate must be part of an installation formal abatement plan, which is reviewed semi-annually. The format of the plan is established by each command.

- 4-2 Fire Safety Deficiencies (FSD's) (Reference AFR 92-1). FSD's, unlike RAC's, are not included in the base hazard abatement program. The fire safety condition is assessed in manner similar to the RAC, except- that any fire safety deficiency caused by operations requires correction without further evaluation of the severity or probability of occurrence. The FSD matrix is shown in Table C-2.

The planner should contact the installation safety office for-the-status of any formal the abatement plan and any open, existing fire-life deficiencies. Fire Protection personnel can assist the planner in identifying appropriate measures to bring retrofitted systems and .facilities into compliance and features to be avoided in new design, installation and/or construction.

FIGURE C-1



- New construction materials or equipment do not meet criteria in effect at time of acquisition.
- Complete automatic suppression system not installed when the facilities/real property:
 - Are mission essential
 - Have a replacement value over 1 million dollars
 - Have a replacement lead time of 3 years.
- Fire-Life Safety Conditions not specifically covered by FSD's.

Notes:

- 1 For Fire Safety Deficiencies (FSD's) Use Table C-1, Fire Safety Deficiency Codes in Appendix C.
- 2 For Fire Hazards, Use Table C-2, Risk Assessment Codes in Appendix C.

TABLE C4

RISK ASSESSMENT CODES

Mishap Probability

Severity	A	B	C	D
I	1	1	2	3
II	1	2	3	4
III	2	3	4	5
IV	3	4	5	5

HAZARD OR DEFICIENCY SEVERITY

I - Death or total disability; resources or system loss, damage over \$500,000.

II - Permanent partial disability; temporary total disability in excess of 3 months; resource loss; damage from \$100,00 to \$500,000.

III - Lost workday mishap; resource damage from \$1,000 to \$100,000.

IV - First aid or minor medical treatment; resource damage or loss less than \$1,000, or violation of a requirement in a standard.

MISHAP PROBABILITY

A - Likely to occur immediately or within a short period of time.

B - Probably will occur in time.

C - Possible to occur in time.

D - Unlikely to occur.

RISK ASSESSMENT CODE (RAC) DESCRIPTIONS

1 - Imminent Danger

2 - Serious

3 - Moderate

4 - Minor

5 - Negligible

TABLE C-2
FIRE SAFETY DEFICIENCY (FSD) CODES

Fire Probability				
Loss Severity	A	B	C	D
1	I	I	II	III
2	I	II	III	IV
3	II	III	IV	V
4	III	IV	V	V

LOSS SEVERITY

1. Loss of life; major monetary loss (in excess of \$1,000,000 dollars); or major mission impact.
2. Permanent disability; severe monetary loss (\$500,000 to \$1,000,000 dollars); or curtailed mission capability.
3. Injury; slight monetary loss (less than \$500,000 dollars); or limited mission impact.
4. No injury or mission impact; minimal monetary loss (less than \$100,000 dollars).

MISHAP PROBABILITY

- A - Likely to occur immediately or within a short period of time.
- B - Probably will occur in time.
- C - Possible to occur in time.
- D - Unlikely to occur.

FSD Descriptions

- FSD I - A severe deficiency
- FSD II - A serious deficiency
- FSD III - A deficiency that may constitute a risk to life and property
- FSD IV - A deficiency where correction may not be feasible and risk is minor
- FSD V - A deficiency that has little or no impact on either people or property

APPENDIX D. N TAB/FIRE AND LIFE SAFETY EXISTING CONDITIONS MAP DEVELOPMENT

The following series of Tabs (N) or maps are recommended for inclusion in the Fire Protection Plan. Depending on the installation, maps may be combined or specific fire protection needs further defined on additional maps.

Water Distribution System (Tab N-1)

The purpose of this tab/map is to show the existing water distribution system and proposed changes. Existing and planned fire hydrants and isolation valves should also be shown. Figure D-1 is an example.

Fire Protection Systems (Tab N-2)

This tab/map should identify facilities that have automatic fire protection such as sprinklers and halon systems. Siamese connections should also be shown. In addition, future fire protection systems should be identified.

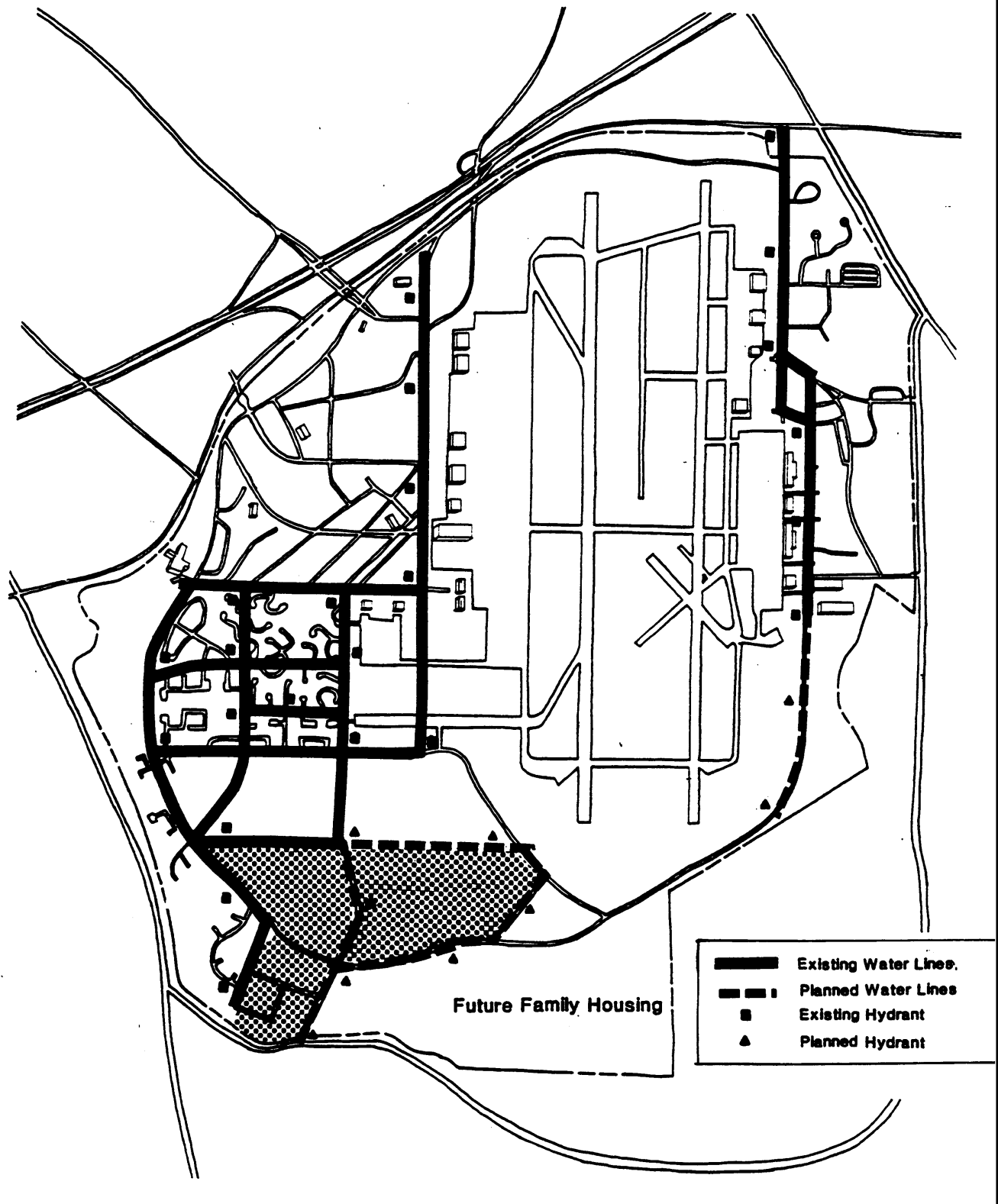
Dividing the installation into functional areas or quadrants would make the maps more readable, would assist in defining access and facility separation requirements, and are useful for full surveys. Figure D-2 is an example.

Utility Cutoffs (Tab N-3)

This tab should show the location of cutoffs/breakers for the electrical and gas distribution systems and the cutoff/isolation valves for aviation fuel system if applicable. Figure D-3 is an example.

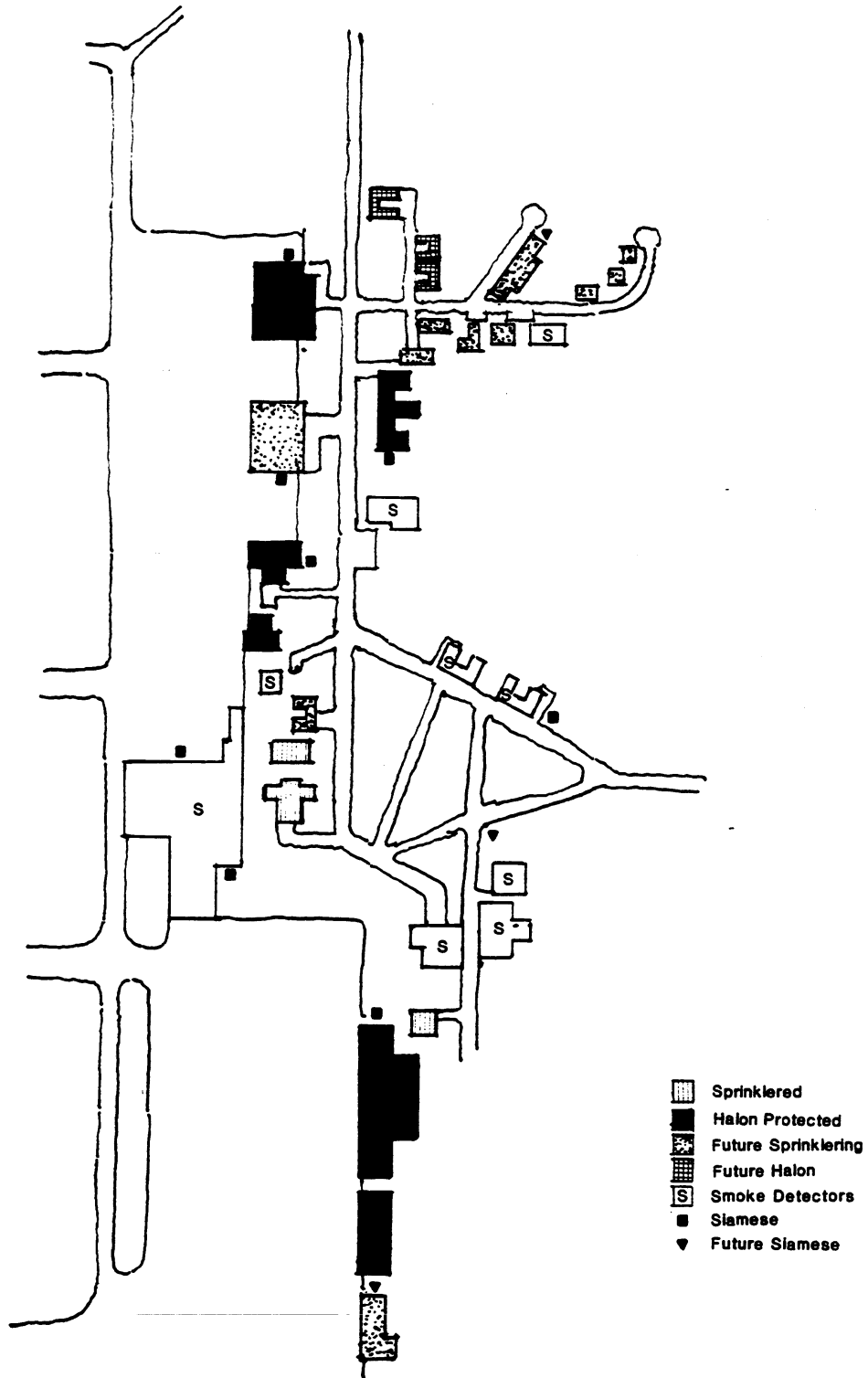
Response Requirements (Tab NA)

This tab/map would show the location of the fire company(ies), key access routes within the installation, as well as the routes to respond to community emergencies. It should also include a response time/distance matrix and possible overlay for the structural fire company(ies), per DoDI 6055.6. An example of this can be seen in Figure 1-7 on p. 1-15 in the main text of this bulletin/manual.

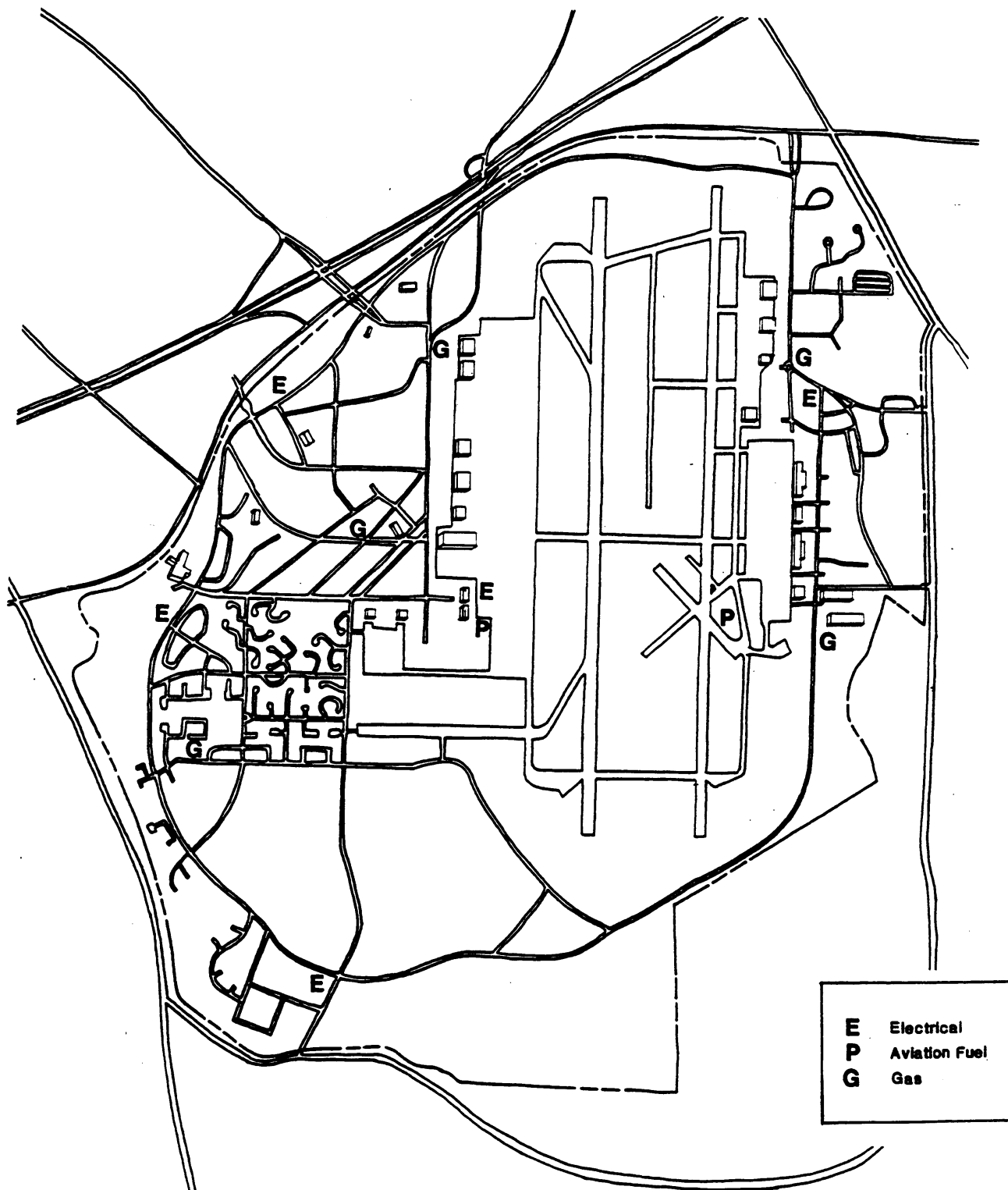


Water Distribution System

Figure D-1



Fire Protection
Figure D-2



**Utility Cutoffs and Electrical
Breakers (substations)**

Figure D-3

APPENDIX E. MODEL STATEMENT OF WORK FOR A CONTRACTED FIRE PROTECTION PLAN

The fire protection plan component of the Base/Installation Comprehensive Plan, shall include sufficient and necessary information to ensure the timely incorporation of fire protection needs in the near-term and long-term planning. The requirements for each installation's fire protection plan must be carefully tailored to meet the specific needs and conditions. As a minimum, the fire protection plan shall include:

1. Introduction
2. Goals and Objectives
3. Fire Protection Situation and Conditions
 - Existing Conditions
 - Risks and Opportunities
4. Evaluation and Recommendation
 - Analyze and Compare Alternatives
 - Recommend Alternative(s)
5. Implement the Plan
6. Monitor the Plan
7. Community Involvement

1. Introduction

Describe the purpose of the Fire Protection Plan and how it is used.

Define and describe the key interfaces with other plan components, as well as the role of the fire protection plan in the overall planning process. In addition, discuss the functions of the installation and community personnel involved in the planning.

2. Goals and Objectives

Provide comprehensive fire protection goals and specific planning objectives. Describe the fire protection data sources and how to plan and conduct a survey in support of comprehensive planning.

3. Fire Protection Situation and Conditions

Identify the existing facilities, structures and land use and their condition, location and relation to one other as they affect fire protection. Describe the risk assessment process and its application to planning.

Discuss deficiencies, constraints and opportunities identified in the survey. Discuss possible causes of deficiencies/constraints, such as changes in occupancy usage, code/standard changes and technology impacts. Identify important physical, natural and environmental constraints and barriers, and graphically locate these. Describe incorporation of the impacts on fire protection into the planning.

4. Evaluation and Recommendation

Describe the method to select criteria to evaluate alternatives and then provide the criteria. Apply the criteria to the alternatives and compare using evaluation techniques. Provide tables which rank the alternatives with recommended near-term and long-term approaches.

5. Implementing the Plan

Describe the steps taken to implement the recommendations as part of the planning process. Include the personnel and agencies that are in the coordination and review cycles.

6. Monitoring the Plan

Describe the activities required to monitor the progress to meet fire protection requirements and how the effectiveness of measures taken will be verified.

7. Community Involvement

Describe the types of agreements that are mutually beneficial and means to develop them.